The Welding Engineer

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Eastern Representative:
T. E. DEPEW, 1834 Broadway, New York, N. Y.
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C. C. MONROE, 608 South Dearborn Street,
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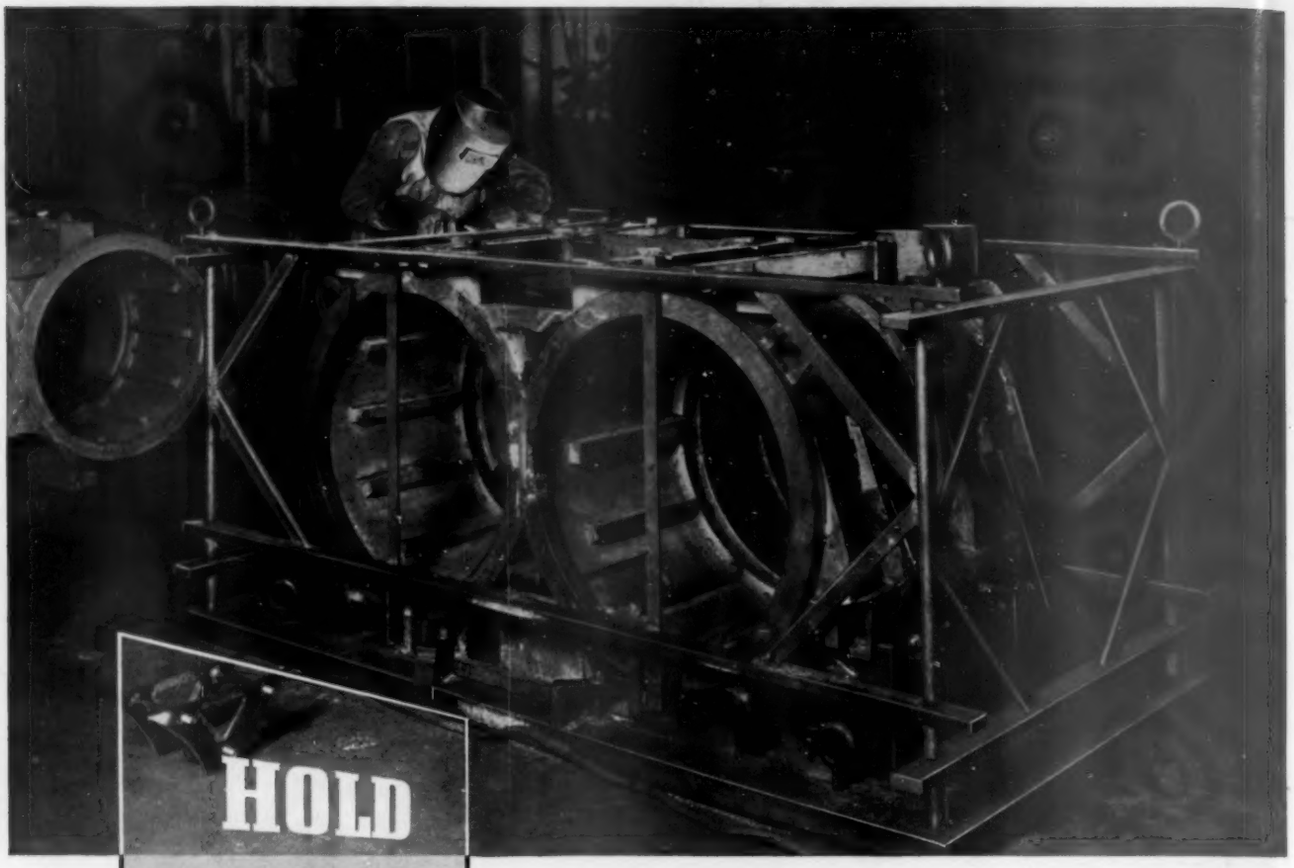

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Construction view of welded steelwork on large industrial building in Great Britain. There are three truss-type girders 500 ft. long, each weighing about 70 tons.

Review of an important report on research

Structural Steel Welding

★ Several years intensive work revealed in data secured to help in design and fabrication of welded steel building structures

By GEOFFREY BLACKALL*

THE MOST IMPORTANT report on welding research yet issued in Great Britain is the report, entitled "Welding of Steel Structures." This report embodies the conclusions of a sub-committee of the "Steel Structures Research Committee." The sub-committee has been working for eight years on the subject, but the most important part of its work has been carried out in the past four years.

The main object of the committee has been to obtain reliable data which may be used as a basis for design and construction of welded steel framework of multi-story buildings. It is believed, however, that the investigations will be found in other applications of electric welding to structural steel work.

The investigations undertaken can be conveniently arranged in four groups, as follows: (A) Statistical examination of the strength of welded joints. (B) Investigation of non-destructive methods of testing welds. (C) Research on the fatigue resistance of welded joints. (D) Survey of existing published information on the design of welded joints.

The main results of the statistical examination are as follows:

1. In the analysis of full results considerable attention has been given to determination of which of the two main variables, i.e., the electrode used, or the workmanship of the welders, should be considered more important. The analysis refers to considerations of strength only, and includes variables such as type of welding plant as part of the workmanship factor. But when the average figures are considered for all electrodes used in the complete investigation, it is probable that quality of the electrode is more important than workmanship of the welder.

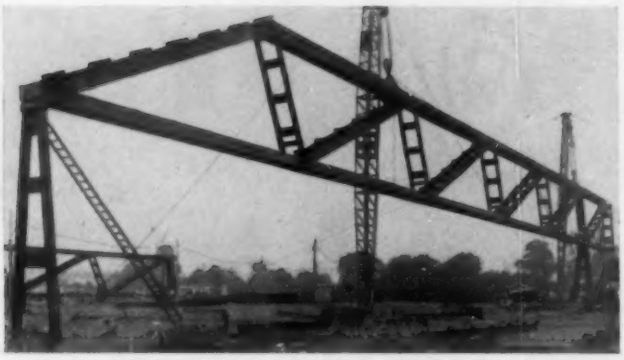
2. In analysis of the results electrodes have been classified as Grade A and Non-Grade A, the former being those from which all-weld-metal test bars were made giving a minimum tensile strength of 56,000 psi., a minimum elongation of 20 per cent, and a minimum notched bar impact value of 30 ft. lb. The results of investigations indicate, in general, that mechanical properties are better and variations in results are less, both for fillet and butt welds, when all welds made with Non-Grade A electrodes are eliminated. In particular, elimination of welds made with Non-Grade A electrodes greatly diminishes the number of low strength fillet welds.

3. For welds made with Grade A electrodes, considering the three criteria, high average strength, high maximum strength and uniformity of strength, the workmanship of the welder is probably more important than variations in quality of electrode used within this grade.

4. Errors of workmanship causing variations in the sizes of fillet welds are unimportant in comparison with other factors affecting strength of fillet welds.

5. The results show that in regard to consistency the butt welds are superior to fillet welds, and that occasional low results are less likely to occur with butt welds. The improvement obtained by eliminating lower quality electrodes is less marked with butt welds than with fillet welds.

*London correspondent of *The Welding Engineer*.



One end of 500 ft. welded main girder and two-legged end column. Said to be longest unsupported roof span of any steel-frame structure in the world (1938).

6. The occurrence of cracked fillet welds might appear to possess significance. Actually, however, of 3,696 fillet welds made with Grade A electrodes (306 transverse specimens, 4 welds per specimen, 309 longitudinal specimens, 8 welds per specimen) only two were found to be cracked.

7. While the majority of the values of ultimate stress obtained in butt weld tests are above the minimum ultimate stress of ordinary structural steel (56,000 psi.), the elongation measurements in tensile and bend tests indicate that ductility of butt welds was much below that of ordinary structural steel.

8. The tests show little difference between average strength of horizontal and overhead fillet welds. On the results of transverse fillet weld specimens (but not on results of longitudinal fillet weld specimens) the average strength of vertical fillet welds is less than that of horizontal and overhead fillet welds. Horizontal fillet welds show appreciably less dispersion of results than either vertical or overhead fillet welds. Horizontal butt welds show greater average strength and less dispersion of strength than vertical butt welds.

Non-Destructive Tests

No satisfactory non-destructive test was discovered. The magnetic and electrical potential difference methods, and also the stethoscope method were investigated at the National Physical Laboratory. The magnetic potential drop method gave a fair degree of correlation with subsequent tensile test results when applied to butt welds. The electrical potential difference method, however, was not so discriminating as the magnetic method.

The investigators found that in general the electric method did not discriminate satisfactorily between good and bad welds. The magnetic method showed a general correlation with mechanical strength, when average results on samples of simple and identical size and shape were compared; but local defects in individual welds could not be detected with certainty, and spurious effects occurred near open edges.

The simplicity of the stethoscope test proved attractive, the weld being tapped with a hammer while the operator listened through an ordinary medical stethoscope, fitted with a soft rubber cap pressed against metal adjacent to the weld. However, it was concluded that the stethoscope test is of no value in indicating fillet welds of low tensile strength of the type examined.

In particular, the method showed no appreciable difference between sound and cracked fillet welds. The method was also found to be of little practical value in examination of butt-welded test plates, although in one case it was successful in locating the position of a definite flaw in an otherwise good weld. Although examination of test specimens and plates is not a conclusive test of the merits of the method, it does not appear that the method is likely to be of much value as a field test.

It is pointed out that the lack of a generally satisfactory non-destructive test is no reason for a general condemnation of welding. In the case of butt welds in structures, radiographic examination can be utilized if doubt exists concerning soundness of particularly important welds.

The results of investigations into fatigue resistance of welded joints showed that under repeated loading, the limiting safe range of stress of unmachined fillet and butt welds was only 14,000 to 16,000 psi.

Main results of this fatigue work are stated as follows:

Fatigue Strength

1. The fatigue strength of actual weld metal is definitely lower than that of mild steel of same tensile strength; this is primarily due to presence of blowholes, inclusions, etc., which act as "stress-raisers" in the weld metal.

2. The fatigue strength of fillet and butt welds is much lower than might be anticipated from ordinary static tests on the joints; indeed, a normal static test on a fillet or butt weld definitely provides no indication of probable strength under repeated loadings.

3. Stress concentrations arising at the roots and toes of fillet welds and the toes of reinforced butt welds, and uneven distribution of stress along the length of fillet welds are of great importance when such joints are subjected to repeated loadings.

4. The high-class covered electrode appears to be much superior to the bare wire electrode for both butt and fillet welds subjected to repeated loadings.

An analytical investigation was made of the possibility of fatigue failure in welded connections of steel floor beams as a result of vibration and shock, this investigation being based on results of experiments carried out in Germany in which the sensitivity of human beings to vibration was observed. Following conclusions were arrived at:

Where floor is carried on main steel members arranged as "encastre" beams by end welding, the intensity of vibration, whether due to continuous vibration or intermittent impacts, will become intolerable to occupants of the room long before there is any danger of failure at the welds, except for very low frequency, large amplitude, vibrations, when the obvious movement and uncomfortable vibration would probably call attention to the danger.

When there are small and very stiff "encastre" secondary beams there is a possibility of fatigue failure with an intensity of vibration or shock which is not intolerable, but large unbalanced forces or impacts would be necessary to cause such failure. The danger is greater where there are impact effects,

Secondary girders (125 ft. span) were field welded in this special jig. Note lightweight construction.

Welded Industrial Building

The illustrations accompanying Mr. Blackall's article refer to an all-welded steel framed structure completed last year for Murex Welding Processes, Ltd., London, England. This industrial building is said to be the largest all-welded structure in Great Britain. It is also said to have the largest unsupported roof span of any steel framed structure in the world.

It is evident from the illustrations that the structural design is extremely unorthodox as measured by American standards. A feature of the building is a truss-type welded main girder. There are three of these 500 ft. long, each weighing approximately 70 tons. These truss-type girders run continuous over the two intermediate supports. The effective depth of the girder is increased over these intermediate supports, as will be noted in an illustration. Total weight of steel work was about 800 tons, averaging 10 lbs. of steel per sq. ft. of floor area.

Another feature is the novel type of welded column for supporting the 500 ft. main girders. These columns support a vertical dead load of 226 tons. As noted in an illustration, each column is an all-welded structure made up of four legs braced together. Another illustration shows a welded end column comprised of two legs braced together.

This steel structure employs many recent advances in welding technique as developed in Great Britain. A marked reduction in number of supporting columns is an outstanding feature. Further economy in steel is accomplished by absence of gusset plates and use of small secondary members.

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as comparatively small falling weights are able to set up large impact stresses; in such cases it would be advisable to arrange the welds at the ends of secondary beams to give an approximately hinged connection instead of an "encastre" connection, thereby reducing bending stresses in vicinity of the welds.

In the light of these results the committee is of the opinion that possibility of fatigue failure need not be considered in design of welded steel framed buildings of normal type. Exceptions to the general rule may arise, however, in buildings in which heavy machinery is resting on the frames, or in which marked impact loading occurs.

Welded two-legged end column before erection. Welded joints are clearly discernable.

The fourth group of investigations comprises a survey of published information on the design of welded joints. In other countries the rate of progress has been more rapid than in Britain. The committee felt that a knowledge of results of published investigations on which foreign progress has been based would be valuable. The task of surveying the whole field of published literature was undertaken by L. F. Denaro. A preliminary survey showed that of roughly 5,000 papers in four languages (English, French, German and Italian), approximately 1,100 contained sufficiently reliable information for abstracts to be made. A summary of this data was then collected as five series of notes under the following heads:

1. The strength of, and the stress distribution in, welded joints.
2. The influence of fatigue on the design of welded connections.
3. Residual welding stresses.
4. Strengthening riveted joints by welds.
5. Welded structural connections.

Part 1 contains data about tests on wide butt-welded plates, fillet welds of various sizes and contours, and joints with butt straps and welds of various proportions. The notes on fatigue in Part 2 indicate the great attention attached to repeated or pulsating loading of structures in several countries, and although the committee found this matter to be unimportant in the design of welded buildings, its importance in the design of such structures as welded bridges must not be underestimated.

The review in Part 3 of the factors affecting the internal stresses produced by welding shows that little is really known about the true effect of these residual stresses on the distortion or load-bearing capacity of a welded structure. Many conflicting views have been expressed, and it appears to the committee, therefore, that until more definite information is available, it is advisable to control such factors as welding process, electrode, welding current, size of weld, etc., so that the minimum practicable residual stresses are present in the joints.

The data on the strengthening of riveted joints by welding is based on results of research work only. There is likely to be considerable difficulty in applying such data to the practical problem of strengthening riveted steel bridges. Riveted joints prepared for laboratory tests differ in behavior from those which have been in use over a period of years, and pure tests

Unorthodox design of main intermediate column for supporting 500 ft. main girder which runs continuous over each of two columns as shown above.

to destruction have been found to give false indications of the stress relief afforded by welds. Investigators agree that riveted joints should be subjected to sufficient load, when reinforcing welds are applied, to eliminate further slip under additional loading.

The committee considers that the data concerning welded structural connections is by no means comprehensive, especially in regard to beam-column connections. Direct connections by means of flange fillet welds only, appear to be unsound, and connections by means of welded web cleats have been shown to be stiffer than usually assumed. A certain amount of data is given to assist in design of tension flange cleats, angle brackets, gussets and brackets, but little is available on the rigidity of beam-column connections. It is evident that bending moments of considerable magnitude may be introduced into the columns in building frame construction.

As a result of the committee's very thorough examination of the whole subject of structural welding it considers that "electric arc welding is sufficiently reliable and trustworthy for

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Copies of the complete report "Welding of Steel Structures," which is reviewed in Mr. Blackall's article, can be obtained by writing to the British Library of Information, 270 Madison Ave., New York City. Price is $1.75 (paper cover). An excellent volume for the serious-minded engineer interested in welding design.

general use in fabrication of joints in steel-framed and other buildings," and it recommends it for that purpose, provided suitable precautions are observed concerning: (a) quality of electrodes, (b) standards of workmanship, (c) methods of design and (d) working stresses.

The committe considers its investigations have produced much new information which should be useful as the basis of a code of practice for use of electric welding in building construction. As the Institute of Welding (London) has undertaken preparation of such a code, the committee has placed results of its investigations at the Institute's disposal. In doing so it offered the following suggestions:

Electrode Quality

The statistical examination shows that the nature of electrode used is probably the most important factor in determining strength and other properties of a welded joint; the results of fatigue tests also indicate that quality of electrode is important. It is desirable, therefore, that only approved electrodes of satisfactory quality should be employed. In tests for approval of electrodes, the committee considers that not only are usual tensile and Izod tests necessary on all-weld-metal test pieces, but that satisfactory results in a suitable butt weld tensile test and a fillet weld test are also desirable. For the fillet weld test the "cruciform" test piece is recommended.

In addition, it is pointed out that electrodes shown to be satisfactory for horizontal welding are not necessarily equally satisfactory for vertical and overhead welding. Accordingly, in approving electrodes for vertical welding, satisfactory test results on suitable butt and fillet welds prepared by vertical welding are desirable. Similarly (and on the assumption that overhead butt welds will not be used), satisfactory overhead fillet weld tests are desirable for electrodes to be used for that type of welding.

The results of statistical examination indicate that, if the welding is confined to high-class approved electrodes, workmanship is the most important matter to be considered. None of the methods of non-destructive testing investigated are sufficiently instructive and reliable to be recommended as general field tests for examination of finished welds in buildings.

However, maintenance of a satisfactory standard of workmanship will probably be achieved by inspection and supervision during course of the work, preferably combined with periodical checking of workmanship by means of tests on sample welds. The periodic tests should be tests on prepared fillet welds, in which maximum breaking stress is determined, and tests on butt welds in which utimate strength and ductility are determined. The sizes of welds and welding conditions of test plates should be representative of welds obtaining in the welded building.

In general, unless definitely arranged to permit freedom of movement, welded connections should be considered as rigid, and bending moments caused by this rigidity should be taken into account in the design of framework. The results of investigations and recommendations for design given in the final report of the Steel Structures Research Committee are therefore directly applicable to design of welded frameworks. In general, the possibility of fatigue failure of welded buildings need not be considered; exceptions to this general rule may possibly arise in the case of a building in which running machinery is resting on the frame, or in which marked impact loading occurs.

Working Stresses

The committee believes the results of its investigations can be utilized to specify working stresses for welded joints in a more reasonable manner than has hitherto been possible. A common method of ascertaining permissible working stress in engineering design is to divide the known ultimate stress of the material by an appropriate factor of safety.

A more satisfactory method is to base the design on a definite load factor, insuring that the structure can carry a load equal to the design load multiplied by this factor. As the load factor method is not familiar to all designers, the committee confines itself to suggestions on use of a factor of safety in deduction of working stresses. Considering application of test results collected, the average values of ultimate stress could be divided by the factor of safety to provide working stresses for the various kinds of welds.

Due allowance, however, for variations of strength occurring in welds is essential. This can be done from results of tests by utilizing the standard deviation values, in addition to the average values. By the application of statistical methods, the standard deviation can be used to obtain values with a prescribed probability of occurrence. By dividing the amended minimum strength values, by an appropriate factor of safety, working stresses based on a combination of average strengths and variations in strength can be derived.

Finally, the committee mentions that the ductility of the metal may also have to be borne in mind when fixing safe working stresses. Results of its tests indicate that ductility of weld is likely to be much below that of ordinary structural mild steel.

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Shop welding a steel truss with the electric arc. Photo (Westinghouse Electric & Mfg. Co.).

Preferred method of smoke disposal is to draw it away through an exhaust ventilating system. Photo (Ruemelin Mfg. Co.).

Simple methods of smoke disposal by means of

Exhaust Ventilating Systems

★ Heavily-coated electrodes and multiple welder installations create greater smoke disposal problem

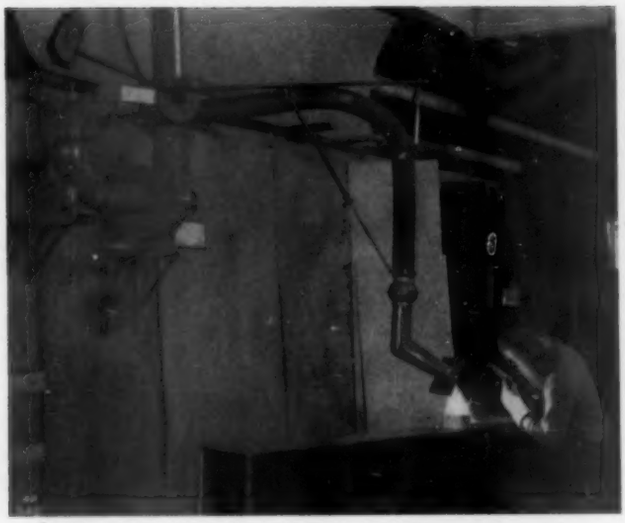
By HAROLD S. CARD

LESS THAN ONE-FOURTH of the total volume of metallic arc welding which was done 10 years ago was done with heavily-coated electrodes, whereas at the present time that classification accounts for more than 80 per cent of the electrode consumption. Some observers have noted the larger production of smoke and fumes from the coated rods, compared to bare rod, and have concluded that there must be a corresponding respiratory hazard. Therefore a number of competent medical men have investigated this suspected hazard in an attempt to evaluate it for the benefit of the users of arc welding. A few of these have reported their findings in considerable detail, findings which are predominantly negative as far as arc welding under average conditions is concerned.

The result is not surprising to practical men in the welding industry who are familiar with the splendid health record of welders over a reasonably long period of years. In lots of metal-working plants, a scientific dust count will find millions of particles per cubic foot. Similarly if a drop of tap water is placed under a microscope an equally impressive picture of millions of bacteria will be discovered. Similarly, if on a summer evening we allow our minds to dwell upon the appalling birth rate among mosquitos, we might appear to be in imminent danger of being devoured; yet we seem to escape with a fairly uniform number of bites per season and with remarkably few fatalities. If we then take into account all industrial uses of arc welding, the healthy condition of the typical welder, and the almost total lack of evidence of health injury induced by the process, the easiest conclusion to accept is that it has been more beneficial than otherwise to the men who work with it.

In a common sense approach to this subject of welding smoke, we would naturally be aware that fresh pure air is the best air, and then proceed to ask whether atmospheric conditions can fall far short of this category and still be tolerable. Immediately we think of chemical works, paper mills, stockyards, glue factories, oil refineries and other odoriferous, but necessary members of our industrial structure, each with its own distinctive stench.

If there were anything very malignant about the microscopic particles which form the base of these various industry "perfumes," whole populations would long ago have been wiped out. In short, they are disagreeable but harmless. Everywhere in these industries, however, we find engineers at work on projected plans for better ventilation and air conditioning—inspired not by fear but by the desire for greater comfort. Here then is the worthiest of



The inlet snout can be set easily at proper distance from the welding arc. Photo (Ruemelin Mfg. Co.).

motives for serious consideration of whatever smoke nuisance exists in any shop where arc welding is done, with either lightly or heavily-coated wires.

Comfort has been a matter of prime importance to good welding supervisors from the beginning. "Get set in a comfortable position, or as nearly so as you can," has always been their advice to the operator. Holding the arc at proper length and controlling both the pool and the molten stream from the electrode is a task that demands vigilant application at every instant when the arc is at work. When the atmosphere is too heavy, the welder will probably become unnecessarily fatigued and sleepy as the day progresses. He will either stop more frequently for rest periods or relax his vigilance. He is more likely to do both. This is all the more apparent when it is noted that although the welder is holding a comparatively light tool, there is usually no mechanical aid for the precision with which it must be manipulated. Also, what applies to the welding operator is equally true of his associates in the shop, a stuffy workroom means stuffy workers.

There is almost never any smoke problem when arc welding is done out of doors. This reminds me of a story about the welding of mammoth storage tank roofs in the Mid-Continent oil fields. The sun beating down on the steel plates by day made them unbearably hot, so the welders laid off and went to work in the early evening. As it grew dark, swarms of large moths and beetles were attracted to the arcs and flew into them. The red hot metal —but let's get away from the wide-open spaces!

Having reasonably good ventilation, the majority of shops get along without any difficulty arising from welding smoke. Enough heat is usually liberated around the arc to make a gentle draft which carries all smoke and fumes harmlessly upward. It is when undesirable concentrations occur, that special measures must be adopted to get rid of them. In any shop the initial installation of welding apparatus may not, and usually does not, produce any noticeable change in the atmosphere.

Fresh Air Deficiency

Then the number of machines is increased and new work is brought in which requires use of larger diameter electrodes, with a correspondingly larger mass of coating to be burned. Production does not come up to expectations and the management wonders what is wrong. Under these circumstances a good rule to remember is to look for a fresh air deficiency. Local conditions will determine whether the corrective means will be as simple as a large electric fan or as elaborate as a blower system.

An actual case of this nature came to my attention about 12 years ago. In a large manufacturing plant, where production arc welding was being introduced, an argument had developed between the workmen who were annoyed by the smoke and wanted the door left open and the welders who worked near the door and declared they couldn't risk having it open in midwinter. Both sides presented hysterical pleas about health hazards to the superintendent. At the suggestion of an interested salesman, the superintendent told me his tale of woe and inquired anxiously about the danger of harm from breathing welding smoke and fumes.

After a bit of reassuring comment, my advice was to look in the storeroom for a couple of large electric fans that the office force probably used during hot weather. I told him to set them up so as to create a mild air current which would carry the smoke and fumes outside, poking out a small pane of glass if necessary for psychological effect. Two days later he phoned me extending lavish expressions of gratitude and assuring me that the result was 100% satisfactory. The temporary expedient adopted to get rid of an emergency gave time for a careful study of all the factors involved and for working out a sound and adequate solution.

Exhaust Ventilation

The preferred means of smoke disposal is to draw it away as in the case mentioned above, rather than to blow it away. The suction method makes it possible to conduct the smoke outdoors, or into a container which may be emptied. Exactly how to plan a ventilating system must depend on a number of factors which are all variable. Out of several layouts used by firms who do a large volume of welding, the writer has been most impessed by the combined efficiency and economy of the one used in the River Works of General Electric Co. at Lynn, Mass.

Many of the welding stations in this plant are so located that no special smoke disposal apparatus is necessary. Others require it a part of the time and a third group of stations need it almost constantly. In the third group, for example, is an aisle of enclosed welding booths. In each of these booths is a separate motor-driven exhaust hood connected by a long flexible tube to an inlet snout, with the tube supported so that it can be kept out of the way of all work. The inlet snout can be set quickly and easily at the proper distance from the arc. Smoke and fumes are collected before they have a chance to spread through the atmosphere, and the whole action affects so small an amount of space that the normal ventilation of the booth is not disturbed. In the case of a larger welding station, where several welders are frequently working on a single heavy structure, a larger exhaust unit is used, to which there are connected four tubes with inlet snouts, so that smoke can be drawn from as many different arcs simultaneously.

Close-up of inlet snout on exhaust ventilating system. Photo (General Electric Co.).

Altogether, this appears to be an admirable system, economical to install and operate and capable of being moved about when a change in location of welding stations becomes desirable. This scheme does a complete job of disposal. It is significant that the installation was not ordered by any outside regulation but was done voluntarily. Welding replaces castings in this plant for many purposes, but welding is in competition here with a first-class foundry and has to advance strictly on its merits. Further, the weld quality specifications are normally so high that the management does not overlook any opportunity to make conditions as favorable as possible.

Exceptionally severe smoke conditions will probably be encountered when welding has to be done in confined spaces, as inside of tanks and pipes. Here it may be best to provide a forced draft of air and perhaps also to send a special supply of fresh air down inside the welder's helmet.

If there is any moral to all this, it is that adequate smoke disposal pays its own way. The literature on the suject does not furnish data enough for working out of a general formula.* Electric fans and second-hand vacuum cleaners are at least better than nothing at all. Removal of smoke at the source seems highly desirable. Of importance also are ease of adjustment, and a means of suspension that will keep the apparatus out of the way of both work and workers.

*A new book dealing with exhaust ventilation was reviewed in *The Welding Engineer*, February, 1939, on page 41.

Simple Traversing Machine For Automatic Arc Welding

By A. M. MacFARLAND*

★ The recent trend in welding shops is strongly toward use of more automatics in seam welding. When we consider that the automatic will do better work than it is possible to do by hand, and that it will weld a seam at a speed three or four times faster than a hand operator, it becomes clear that the only limitation upon its use is that imposed by financial considerations.

The ordinary job shop has a variety of work and frequently this will include a considerable amount of straight seam work, adapted to the automatic. Also, if a shop has an automatic, it can figure a lower price on straight work, and give its employees the benefit of more work.

A complete automatic outfit, including the automatic head, or wire feeding unit, the motor-generator set, or other source of electric power, and the machine for holding the work, and traversing the automatic head along the seam, may run into considerable more money than the small shop can afford.

In the February, 1938 issue of *The Welding Engineer*, the writer gave details of how to build a complete traversing machine, with powerful hold-down clamps, adapted to hold in position thin sheets that would otherwise buckle.

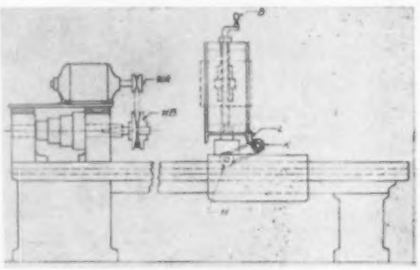
The machine here illustrated will do everything that is necessary for welding plates that are thick enough to be held in position by tack welding. It will take care of a large percentage of the ordinary jobs. It may be built from an old machine lathe, purchased at junk prices. The electric power may be supplied by any of the shop's hand welding generators, up to the limit of their capacity. Some welding machines are adapted to parallel operation, and may be hooked up to supply double power for use of the automatic. Although arguments are commonly put forth against this practice, the fact is that many shops are successfully running automatics with this kind of power.

*Welding and Production Engineer, Freeport, Ill.

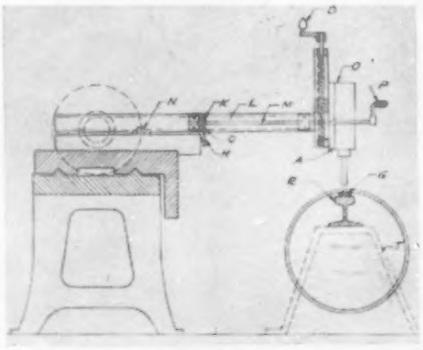
The requirements of a traversing machine are: (1) To hold the work in position, against a suitable backing; (2) To traverse the head along the seam at a steady uniform rate, providing means for adjusting the speed of travel from a few inches per minute up to three or four feet per minute, or even faster.

In the illustration, an old lathe, with screw cutting equipment is used. The adjustments provided for cutting various pitch threads may be used for the finer speed variations, while provision for the larger speed adjustments are taken care of by means of the variable pitch vee pulleys *WA* and *WB*. These adjustable pitch pulleys are made by a number of different manufacturers, and some of them have a range of pitch adjustment of 500%.

A motor of about ½ hp. is shown, mounted on a sliding base, above the head stock of the lathe. An extension arm *L* is attached to the cross slide gear of the lathe, preferably by means of the



Front view of old lathe fitted up to hold an automatic arc welding head.



Side view of "home made" traversing machine for automatic arc welding of seams.

tool post *N*. The crank by which the slide is operated is removed and replaced by the sprocket *H*, which may now be operated by the crank *P*, conveniently placed at the operator's stand, where he may watch the arc, and make such adjustments as are necessary. The drive comprises the shaft *M* and the sprocket *K* and light connecting chain *Q*.

The welding head *O* mounted on the up-and-down slide *A* which is operated by the crank *B*. This slide gear may be purchased complete, or the lead screw and nut may be purchased as a stock article, and fabricated with a section of channel, as shown. Two or three inches is about all the vertical adjustment that will ordinarily be required.

A piece of old railroad rail is shown acting as a work support at *R*. A backing strip *G* (preferably of copper), is shown attached to the top of the rail. This strip may be provided with a cutout, to allow the seam weld to penetrate and form an inside bead if desired. The legs *T* at each end, support the rail. Clips mounted on the rail, serve to hold the ends of the tank or cylinder in position.

In place of the rail support for tanks or pipe sections, a flat iron table may be used to hold odd jobs that carry short seam welds. It is a great convenience and saver of money, to be able to make short seam welds of high quality, and at high speed.

The coil of welding wire may be mounted on the carriage, or on the floor, and the wire draped high above the lathe, guided by properly placed pulleys. The floor mounting avoids the job lifting the coil of wire. Quite a number of shops prefer this arrangement, because one man can handle replacements. (The coils weigh about 150 lbs.)

Steel plate below ¼ in. in thickness may be readily welded at a speed of three or four feet per minute, with a current below 500 amp., the exact figures depending on the degree of penetration required.

» «

Discussion of Trend in Radiographic Applications

By HERBERT R. ISENBURGER*

★ The American Welding Society and its editorial committee deserve the highest credit for a most useful contribution to the advancement of welding knowledge. The A.W.S. Welding Handbook includes an excellent chapter on radiography (pages 687 to 701) and this valuable testing tool has been mentioned in various connections by 15 other authors in describing applications of welding. To help explain modern x-ray technique I offer the following discussion of x-ray data presented in the A.W.S. Welding Handbook.

PAGE 88—In discussing shielded arc welding it is stated that "x-rays test for defects." We prefer to advocate x-ray tests for soundness. As demonstrated throughout the handbook, the art of welding, equipment and technique have been developed to such perfection that defects can practically be eliminated if the work is done under procedure control. For some important work radiographic inspection is valuable to prove the soundness of the material.

*St. John X-Ray Service, Inc., Long Island City, N. Y.

PAGE 626—Test plates are x-rayed (1) to see whether the weld metal is sound enough to warrant the expense of physical tests, or (2) to lay out test coupons on the exograph before the plate is cut up.

PAGE 636—On nickel-clad steel vessels it is recommended to use an x-ray technique whereby two exposures are made approximately parallel to opposite scarfs. In that way lack of penetration can more readily be discovered.

PAGE 687—Acceptance tests are now usually carried out by the producer of welded structures. Logically and rightfully they should be done under the supervision of an impartial x-ray expert for the benefit of the purchaser and user of the material, or an independent x-ray laboratory should undertake the testing. A manufacturer wants to convince himself that his workmanship and material are acceptable before delivering the job to his customer. The latter, on the other hand, may be suspicious by nature and may prefer to have his own representative pass on the inspection. It is, therefore, predicted that in the future industrial radiologists will pass on the x-ray inspection which has been carried out by the manufacturer, and in a good many cases they will examine the material personally for the benefit and protection of the purchaser.

PAGE 689—X-Ray examination is also used to develop new welding materials, like rods and the like. Furthermore, it is an important psychological factor which, unfortunately, has often been abused. Some people specify in their order that the material will have to pass radiographic examination, or tell the welder that he must be specially careful since his joints may be x-rayed, when in fact they never intended to do so.

PAGE 743—Of great advantage to inspection of pressure vessels in shops and field is the use of portable equipment with shock- and ray-proof tubes having 30 ft. long cables. The tube can readily be placed at the inside of the drum since it is small enough to pass through manholes. In that way, circumferential seams may be x-rayed in three exposures and no rotation of the vessels is required.

PAGE 771—This statement released by the Bureau of Engineering, Navy Dept., is worth repeating: ""Up to thicknesses of 2 in. the x-ray method is more sensitive and requires much less time." This is in agreement with our own experience where we have found that gamma-rays do not give the necessary results. It automatically eliminates the use of radium or radioactive materials for inspection of most welded joints.

PAGE 858—To be logical, in pressure vessels not only all longitudinal and circumferential joints should be x-rayed, but also nozzle seams and other possible welds in the shell should be examined in that way. Up to a short time ago this would have been very difficult. But now tubes are available which make the examination of any type of joint possible.

PAGE 876—It is gratifying to see that people who were very much opposed to x-ray inspection seven years ago are now advocating the examination of "all test welds as well as production welds."

PAGE 891—According to the writer's information there are almost 100 industrial x-ray installations in use today.

PAGE 909—"The cost of radiographing field-erected vessels is now practically prohibitive" and on

PAGE 1023—On welded bridges, "laboratory and to some extent, shop investigations of welds by the use of invisible rays . . . are possible, but such procedure is, at present, expensive, and requires equipment, the use of which would be highly difficult under field conditions in general, and practically impossible in the inaccessible situations of many connections." Due to the fact that suitable x-ray tubes have been available, European engineers have x-rayed welded bridge structures almost as long as our A.S.M.E. Boiler Code has made x-ray inspection mandatory. We have the same types of tubes available in this country now and are using our equipment on all locations wherever a welder is able to do his work.

The increase in cost for field inspection is no more than the relative difference in price between shop and field welding. While the welded seams in oil storage tanks and pipe joints should be examined 100%, other welded structures like bridges, buildings, and the like, do not require such complete examination unless it is justified by special circumstances. The welders understand at the outset that their work will be checked by x-rays. The engineers will then designate

(Continued on page 36)

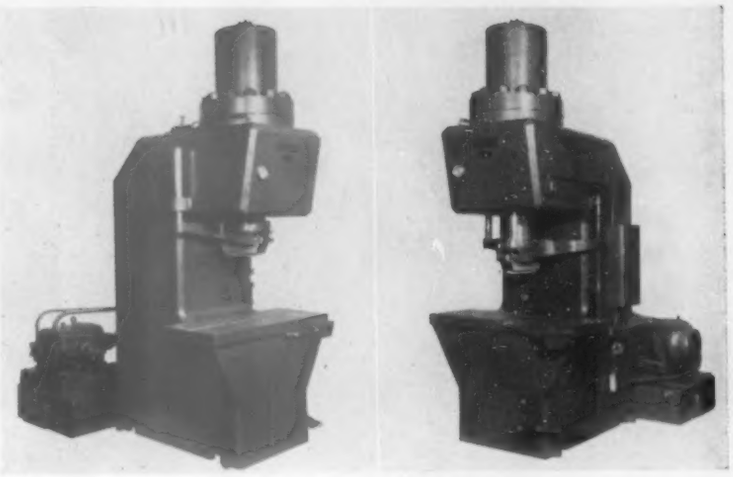


Fig. 1—(Left) 200-ton gooseneck type straightening press.

Fig. 2—(Right) Control side of same 200-ton press shown in Fig. 1.

Welded rolled steel makes better

Hydraulic Press Frames

★ Plates up to 3 in. thick are flame cut for main press frame—Welding permits all manufacturing operations to be done in one plant

WELDED FRAMES for hydraulic presses are a comparatively recent development. One of the better known machinery builders of this type of equipment, The Oilgear Company, Milwaukee, Wis., has revamped its production set-up and enlarged its plant since converting its line of presses from cast frame to welded steel plate. As shown in Fig. 1 the press frame and motor mounting of the Oilgear 200-ton gooseneck type straightening press are of all-welded construction, using plates "knitted" together into a rigid assembly and then normalized. In fabricating these presses, plates up to 3 in. thick are used for the main section of the frame.

The frame of the 200-ton press weighs 12,800 lbs. and requires over 1100 lbs. of welding electrodes to fabricate. The complete press weighs 19,000 lbs., is 10 ft. high and occupies a floor area of 72 in. by 88 in. These welded presses have been subjected to physical tests to determine deflection under full load. Careful tests show that the maximum deflection is only .025 in. at full tonnage, measured on the center line of the ram. Other features of the 200-ton Oilgear press are the sensitive control of the variable ram movement and the provision for changing the Oilgear pump and motor drive, whenever greater speed and production are required.

In fabricating the frame the welders begin with one side plate and tack to it the main 4-in. thick plate and all internal ribbing, before tacking on the opposite side plate. After these plates are securely welded, the table plates, supporting ribs, external front plates, top plates and back plates are corner welded in place, making a rigid fully-enclosed steel structure. Refer to Fig. 4 for details of assembly.

The pump and motor base, which also acts as an oil reservoir, is made separately and fully machined, before being welded to the press frame. All finishing operations on the frame proper are performed after all plates have been welded in place and the stresses relieved.

Since this press is somewhat special in design, an elaborate pattern would have been required for the main C frame structure. There would have been little opportunity to derive any future profits from the special pattern work which would have been involved if castings were used.

Straight line modern construction, which is easily accomplished through the use of welding, would no doubt have been forfeited if castings were used, because in the previous designs, the necessary ribbing was external. Changes in specifications or designs, which often follow after the machine is in construction can more easily be accomplished on the welded steel structure than on the cast type.

All Under One Roof

With the welded steel construction, the entire manufacturing of the press is completed in the Oilgear Co.'s shop and in this way all work receives careful supervision from men who are acquainted and thoroughly familiar with the detailed requirements. Welders become familiar with the standard structures manufactured and in this way the design engineers are assured that the proper quantity and quality of welding is being performed at the important sections of the structure.

Presses, 50 tons or more capacity, are of the enclosed box-type design,

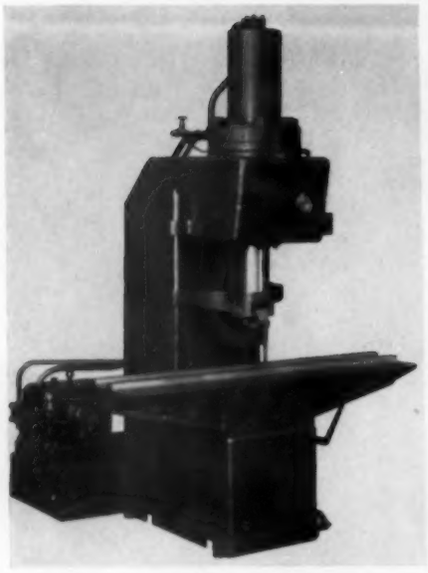


Fig. 3—75-ton straightening press with a 70-in. by 14-in. special (welded) detachable table.

with the control mounted on the side. To insure the proper rigidity and to minimize deflection, it has been found advisable to mount the simple control on the side of the press, rather than inside of the frame, which would necessitate several cut-outs for mounting purposes and clearance for the moving ram arm. Although Oilgear has made tables 96 in. long integral with the main frame structure, they have found it difficult to machine this equipment in their own plant and, therefore, have resorted to a separate welded steel table which is bolted to the main frame structure, after both have been independently machined.

It is particularly significant that the main piston, the ram arm, the two control brackets and various parts of the Oilgear pumps are the only castings used on this press. Welded steel construction is used in the manufacture of the hand lever, the foot pedal, the ram nose and the main press control brackets.

The general stresses incurred during the welding process are relieved by subjecting the frame to a heat treating temp. of 1000 deg. F. for 3 or 4 hours.

Number 851 — Wilson electrodes 5/16 in. and ⅜ in. dia. are used on the majority of the joints, while some No. 107 electrodes are used for tacking and finishing welds. Approximately 8 passes are used in welding the 1½ in. corners which are shown on the top, front and "C" part of the frame in Fig. 4, while approximately 5 passes are used on a number of the smaller

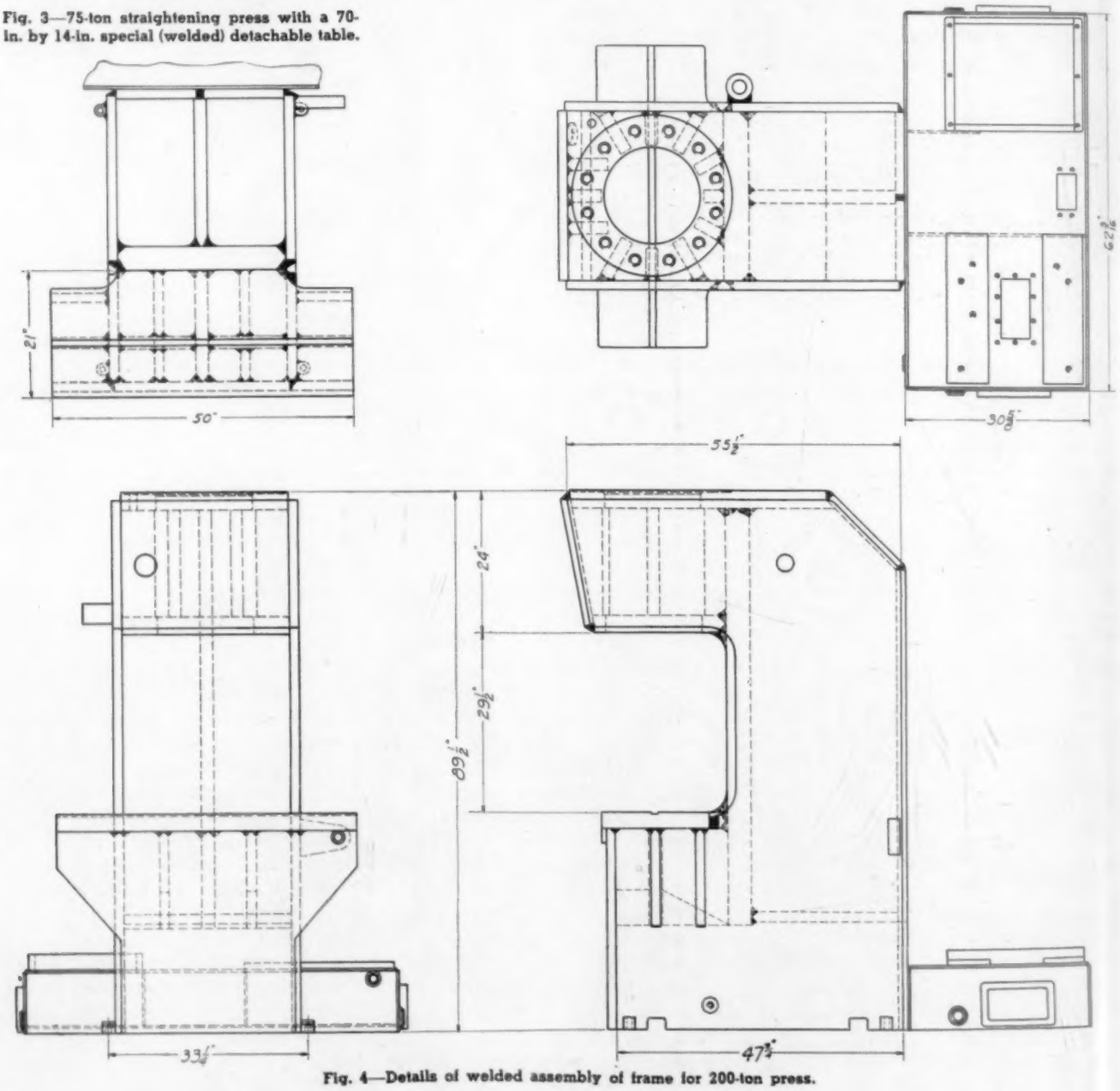


Fig. 4—Details of welded assembly of frame for 200-ton press.

corner welds. This does not include the number of passes required to fill in the 4 in. radii, which are made more for reasons of appearance than for strength.

With the straightline welded steel construction, many improvements in design have been possible and these have been instrumental in creating a greater sales appeal for special equipment. Figures 3 and 5 further illustrate the use of welded steel construction in the fabrication of Oilgear

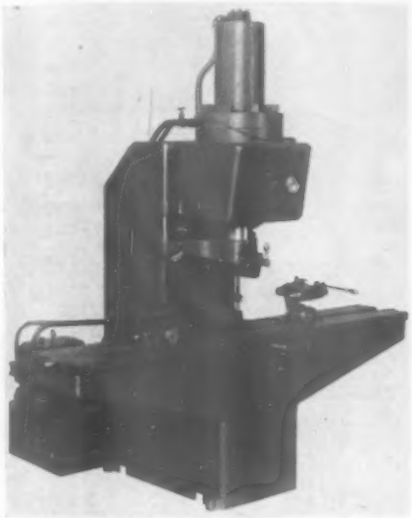


Fig. 5—75-ton straightening press with 96-in. table welded integral with frame.

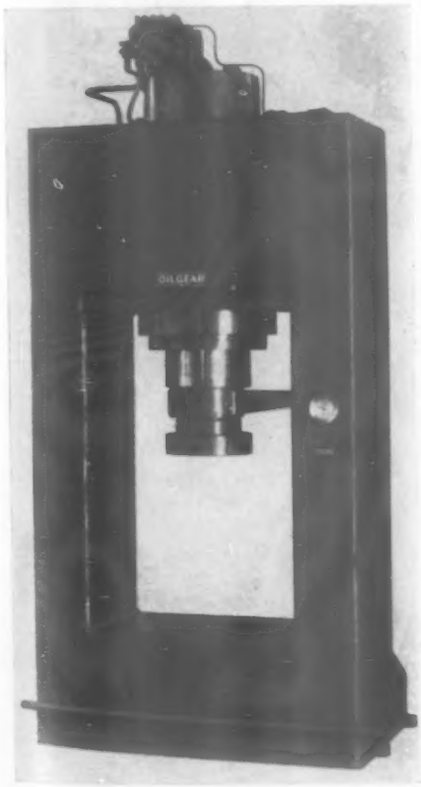


Fig. 6—300-ton, two-column speed press for die straightening of malleable iron castings.

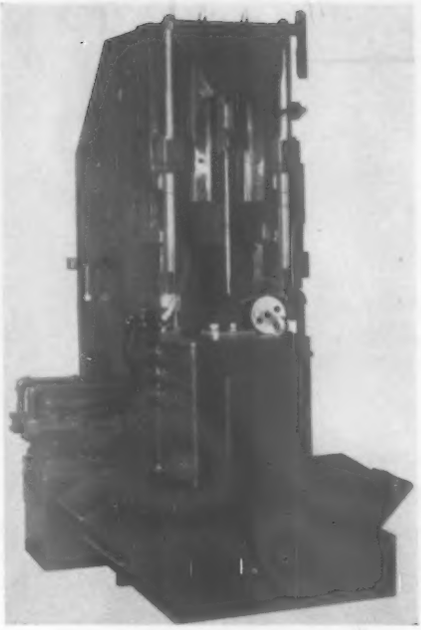


Fig. 7—6-ton vertical pull-down broaching machine for machining holes in crankshaft and cam shaft timing gears.

gooseneck straightening presses. In Fig. 5 the press has a 96 in. table welded integral with the frame structure. Figure 3 shows a 75-ton press with a special (welded) detachable table, 70 in. long by 14 in. wide.

300-Ton Speed Press

The Oilgear Co. also makes a 300-ton speed press for die straightening malleable iron castings (Fig. 6). With this equipment the castings are squeezed to proper shape under close tolerances. The casting is subjected to a cushioned squeeze between dies and the press maintains pressure on the metal between the dies long enough for the metal to flow.

The rigid main press structure, consisting of the base, side frames, yoke and oil reservoir, is uniformly welded into one compact piece weighing 17,500 lbs. Heavy steel plates, each with a large center cut-out, are used in the front and back of frame. These are connected by welded plates forming rigid box type side frames and substantially ribbed base and yoke. A large bottle type steel cylinder weighing 3000 lbs. is built into the press yoke and equipped with a guided ram and piston weighing 3300 lbs. The rapid traverse cylinder is built in the main piston and ram with the piston rod fixed to the top of the main cylinder. An Oilgear surge valve, flanged integral with main cylinder, provides free flow of oil to the main cylinder during the rapid traverse cycle. Smooth fluid power operation is provided by an Oilgear two-way variable delivery pump direct-connected to a 15 h.p., 1140 r.p.m. electric motor and mounted on the reservoir integral with the back of press.

Six-Ton Broaching Machine

Oilgear Co. manufactures a six-ton broaching machine for production machining of holes in crank shaft and cam shaft timing gears (Fig. 7). These holes are broached to size with a plus or minus tolerance of .0005 in. at a rate of 270 gears per hour.

The broaching machine frame, table and base are of all-steel welded construction. Hardened and ground steel ways with conventional take-up, guide the tool and main slides. Cams on both slides can be adjusted to suit the stroke required. An Oilgear two-way variable delivery pump supplies fluid power for quick, controlled operation of both slides. The cutting and return speeds of the main slide can be adjusted independently.

Welded Hortonspheroid water tank recently completed at Brookline, Mass. Has capacity of 1,660,000 gals. and measures 90 ft. extreme diameter by 47½ ft. high. Designed and constructed by Chicago Bridge & Iron Co., Chicago, Ill.

Brief Sketches of Welding Jobs

Special Fixture Aids Welding of Stator Frames

By J. H. YEAGER*

★ It is always of great convenience to a welder to be able to turn his work so that it constantly bears the same relation to his hand and welding rod. This is particularly true in the welding of feet and braces to stator bands in the manufacture of a-c. induction motors. Since feet and braces present a multiplicity of angles in welding, it was found worthwhile to put some time and effort on designing a fixture which would make it possible for the operator to weld in any spot of the frame without changing the angle of his welding rod with respect to his body position.

To accomplish this the fixture was designed with two axes of rotation so that any point on the work could be made to describe a spheroid, the shape and size of which depends upon the position of the point. The first axis of rotation derives its motion from a short shaft located directly under the work. This allows the work to rotate about its own axis.

This first axis is held by an arm which is in itself capable of rotation about a second axis at a pre-determined angle at the opposite end of the arm. This in effect permits the rotation of the supporting arm on the surface of a cone. In the accompanying illustration the stator frame is shown in several successive positions, achieved by using combinations of partial rotations about both its own and its supplementary axis.

The foot pedal shown in the illustrations serves to release a plug clutch in a face plate around the second axis of rotation to the right of the fixture. Several positions of stators can be obtained readily by providing properly spaced holes in this face plate. For some applications, however, a friction clutch may be found preferable to the foregoing arrangement because it can hold the face plate at any desired angle.

This fixture has not only greatly reduced operator fatigue and increased his efficiency —it has further increased production by making it easier to manipulate the work through the variety of positions required to complete the necessary sequence of welding operations.

*Tool Design Department, Reliance Electric & Engineering Co., Cleveland, Ohio.

Fig. 1—Work in loading position. Feet are held against band in welding position by means of clamps.

Fig. 2—Work has been moved around its own axis and about the axis at end of large arm to allow welding rod to be held at best working angle for operator.

Fig. 3—Work moved again through both axes to maintain position of rod at a different point on the work.

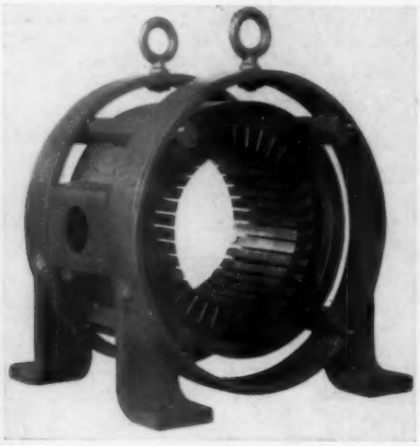


Fig. 4—Stator ready for winding. A fixture (Figs. 1-2-3) facilitates welding in the hard-to-get-at corners of this stator and helps to make a strong, rigid, welded frame for the laminations.

» «

Streamlined Tug Built By Arc Welding

★ The smooth, sleek appearance possible in arc welded steel construction is indicated in this photograph of the business end of a towing tug recently constructed by Canadian Vickers, Ltd., Montreal, Que. The vessel is characterized by a raking stem, flat plate keel, and hull especially stiffened for working in ice. The stern is of special construction designed for the incorporation of Kort nozzles which are built homogeneously with the ship's hull around each propeller.

Special nozzles and rudder structure of welded steel towing tug. Photo (Wilson Welder and Metals Co. Inc.).

This is a unique departure in Canadian shipbuilding circles and one which has aroused widespread interest, although very generally adopted in Europe. Incorporated in the nozzle structure are twin Oertz streamline rudders, the Oertz and Kort companies having cooperated in this development in order to develop high efficiency in operation. A convenient arrangement of the rudder permits removal of propellers and tailshaft.

» «

Welded Machine To Harvest Sugar Cane

★ Native sugar cane cutters in Hawaii will stand awestruck when this monster cane harvester starts gobbling up stalks of cane like some starved mammoth which has chanced upon a field of particularly luscious grain.

This giant—compare its tire (7 ft. diameter) with the truck in Fig. 1—started its journey recently to Hawaii where it will be put into operation by the Honolulu Sugar Planters' Association. Built as an experimental unit, the harvester will be "field-engineered"; any changes proved necessary by operating trials will be made by means of equipment on the truck shown in Fig. 1. This truck is a traveling fabricating shop fitted with Lincoln arc welding equipment,

Fig. 1—Huge sugar cane harvester shipped recently to Honolulu, Hawaii. Photo (Lincoln Electric Co.).

driven by power take-off from the truck drive shaft. The arc welding truck, which makes it possible to weld new structural parts in the field, if necessary, will accompany the machine until all mechanical or structural "bugs" are ironed out.

The sugar cane harvester was built by R. G. LeTourneau, Inc., Peoria, Ill. It has been in process of development for many months. In constructing the harvester, R. G. LeTourneau, Inc. employed the arc welding process which it uses in its production of heavy earth-moving equipment. Because of its simplicity and flexibility, and because of its structural benefits, arc welding made construction of the harvester possible.

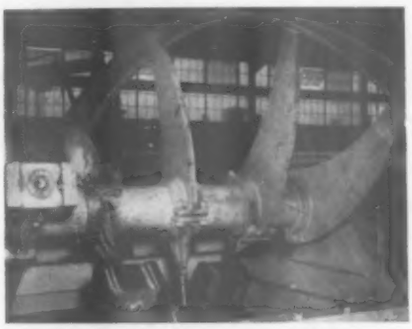


Fig. 2—Close-up of cutting mechanism of sugar cane harvester. Note arc welded counterweights. Photo (Lincoln Electric Co.).

The cane harvester will cut the cane just below the surface, yet high enough to avoid injury to the roots. As it cuts the cane, the machine will pick up the stalks, take them into its cutting compartment, cut them into pieces approximately a foot long, then carry the pieces by conveyor mechanism to trucks or wagons which will travel along beside the harvester. A view of the cutting mechanism can be seen in Fig. 2.

The engine is a 160-hp. diesel built by Caterpillar. The large generator on the front of the engine (See Fig. 1), is for furnishing power to electric motors which drive the conveyors, etc. This huge piece of machinery will be operated by only one man.

» «

Welder Fabricates Motor Housing

By ELTON STERRETT

★ With space at a premium in the closely drilled section of the East Texas oil field lying within the city of Kilgore, Texas, many ingenious devices are developed to provide necessary pumping equipment and economize on space required.

Built up within the four corner angles of the Samson post of this pumping rig, the welded motor house protects the power unit from weather and thieves.

One such space saving idea is evident in the illustration. Within the four angle-iron legs of the Samson post atop which the pump beam oscillates, the electric motor driving the pump reduction gear is placed. Surrounding this motor and the Vee-belt drive connecting it with the gear reduction unit is a tank steel house, formed from flame-cut sections fitted to the angles, and firmly welded thereto.

In one side is set a sheet steel door, also welded and with hinges welded to the angle. The top or roof is built up of four sections of tank plate, welded to form a four-way shed, and normally fitting down to form a seal with the walls. This roof is carried on four angles which can be raised and pinned to the side walls, giving a four-inch air space around the top for motor ventilation.

This motor enclosure cost less than a frame or corrugated iron building, saves space, and adequately protects the power unit from the elements and unauthorized interference.

» «

3% Nickel Increases Life of Trackwork

★ By adding nickel to austenitic manganese steel, it has been found that the carbon can be lowered, and the steel still retains its austenitic structure. This lessens the tendency for carbide formation along the critical-heat line in welding, and hence solves the problem of fusion welding.

Two solid turnout frogs cast in a composition containing approximately .085% carbon, 13.80% manganese, 1.00% silicon and 3.50% nickel, were installed late in 1934 at the busiest location in the Chicago yards of the Chicago, Milwaukee, St. Paul & Pacific Railroad. These frogs have stood up excellently during this four-year period, being maintained by welding periodically without removal from the track.

This service being highly satisfactory, two later installations were made in crossings for the Milwaukee Road, in which one end frog and one center frog were of the manganese-nickel composition, the other end and center frogs being of standard 13% manganese steel, as a test installation designed to give a definite comparison between the straight manganese steel and that with nickel added, since the same traffic would have to pass over both crossings. After two years' service for the composite frogs, C. E. Morgan, superintendent of works equipment and welding, writes: "We have found no cracks in the manganese-nickel trackwork, and this, with its adaptability to maintenance by welding, seems to make it superior to the Hadfield steel."

Nickel-manganese steel (3% nickel) railway frog which has given excellent service during past 4 yrs on The Milwaukee Road.

This manganese-nickel steel, known as "Manganal," is produced under patents of the Stulz-Sickles Co., of Newark, N. J.

» «

Pittsburgh School Prepares Welders for Heavy Industries

★ A recently organized welding school in Pittsburgh, Pa. announces that its objective is the training of welders for employment in shops where important industrial machinery, including high-pressure piping and pressure tanks, are fabricated. Welded construction is increasing so rapidly in this steel center as to make this training attractive to many young craftsmen in the district.

Courses in gas welding, electric arc welding, and combination gas and arc welding make up the curriculum. This covers the welding of light gauge, medium and heavy plate material, pipe welding, cast-iron, some of the alloy steels and non-ferrous metals.

This Pittsburgh welding school is well equipped with modern gas and arc welding equipment. Photo (Wilson Welder & Metals Co., Inc.).

After the student has completed the routine shop training he is given tests in accordance with A.W.S. standards. No student is permitted to graduate until he has satisfactorily passed these tests in the flat, vertical and overhead positions.

In addition to practical shop training, students meet for regular sessions in the classroom, where they study theory of welding. Subjects covered in the classes include design of welded joints, distribution of stresses, metallurgical and chemical reactions that take place in welding, methods of compensating for shrinkage and controlling distortion, methods of estimating welding costs, etc. In addition to welding, all students learn to use the oxy-acetylene cutting torch. At the head of the teaching staff is M. R. Semmer, who is also one of the instructors of the welding department at Carnegie Institute of Technology. Mr. Semmer is assisted by five instructors.

For men who are already welding and wish to further their welding knowledge, an advanced course is provided. It covers gas and electric arc welding on steel plate, pipe, and non-ferrous metals, giving special attention to vertical and overhead positions. It teaches all phases of "code" welding and other high-pressure work. The classroom work delves into the theories of welding and is designed to give the necessary engineering and metallurgical training required.

Located at 318 S. St. Clair St., the school is equipped with a library, a lecture room, testing apparatus, 2 complete oxy-acetylene cutting units, 8 complete Airco oxy-acetylene welding units, and 11 Wilson motor-generator arc welders.

» «

Welded Steel Tanks For Underwater Floodlights

★ Nearly two miles of single bead arc weld will be used in assembling the 585 tanks for underwater floodlights to be used in the New York World's Fair "Lagoon of Nations." These tanks must be watertight. The tank assembly operation is broken down into two steps. The operator on the left (Fig. 1), is tack welding the pieces while they are held in accurate relationship to each other in the universal fixture. The second operator completes the job.

The metal is 12-gauge steel, and 3/32 in. Westinghouse Brown Crucible weld rods are being used for this job. The universal fixture used on this work is made up of a portable table built of 6-in. H-beams and mounted on casters. Leveling jacks on each corner make it stable in a chosen position, and also make it possible to level it in position. The working surface has been planed, and the edges between beams machined to accommodate T-bolts.

Fig. 1—Arc welding steel tank for underwater floodlight to be used at New York World's Fair.

The angles were fabricated from 1 in. by 6 in. steel and planed to a true right angle and slotted holes on 6 in. centers provided for making them as flexible in their set-up as possible. Layouts of any size within the range of the table can be made. Accuracy in assembly and welding is highly essential since the end pieces carry bearing points for the drum assemblies for which the tank is to be used.

» «

Cleveland's New Main Ave. Bridge to Open June 30

★ Cleveland's new $7,000,000, 6 lane, 1½-mile-long, Main Ave. bridge, being built to relieve traffic congestion over the Cuyahoga River on the west side, will be open June 30.

The structure is now approximately 75 per cent completed. Workmen have begun arc welding the new type floor grating which will form a network of reinforcing steel for the concrete pavement. The Main Ave. bridge represents the largest use of arc welding in bridge construction ever made on any Cuyahoga County project. The bridge involves over 60 miles of arc welded joints.

Two 120-foot spans, which are in reality two bridges, one for the north and one for the south ramp, tying the bridge proper to the westerly approach, are of arc welded construction. They contain approximately 30 miles of arc welded joints.

Of the other 30 miles of welding on the bridge, 14½ miles are in the floor grating which is laid in panels and arc welded together; 10 miles in the steel railings, all of which were fabricated by arc welding; 4½ miles in the steel curbings; and 1 mile in the modern lighting standards.

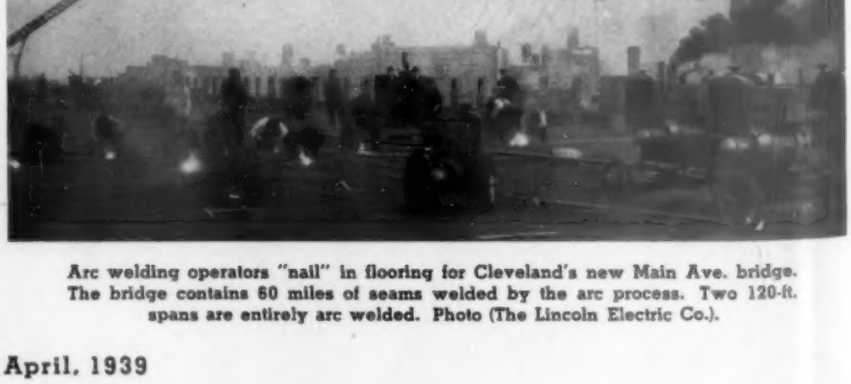
Arc welding on the bridge is being done by Great Lakes Welding and Boiler Co. and Bass Construction Co., both of Cleveland. These contractors are using Lincoln "Shield-Arc" welders and Lincoln "Fleetweld" electrodes.

» «

Welding Aids Shortening of Truck Chassis

★ A contractor in Schenectady, N. Y. wanted to shorten the chassis of one of his trucks, add a new body, and convert it into a dump truck. William Kutassy, who operates a local welding shop, did the job quite simply. He cut two-foot sections out of the channel-iron frame with an oxy-acetylene-torch and then welded the shortened members together with a General Electric gasoline-engine-driven arc-welder. The photograph shows the welding operation and the sections of channel-iron removed from the chassis.

Cutting length of truck chassis two feet was an easy job for this welder. Photo (General Electric Co.).



Arc welding operators "nail" in flooring for Cleveland's new Main Ave. bridge. The bridge contains 60 miles of seams welded by the arc process. Two 120-ft. spans are entirely arc welded. Photo (The Lincoln Electric Co.).

Brief Sketches of Welding Jobs

Portable X-Ray Machine Makes Flaw Detection Easier

★ The latest weapon in the campaign against flaws in industrial products, a 220-kv. portable x-ray flaw detector, recently was placed in service in examining structural welds and heavy castings on production lines at the East Pittsburgh works of the Westinghouse Electric & Mfg. Co.

The technique of radiographic diagnosis of large steel parts is expected to be much simplified by this 4500-lb. portable x-ray camera, since it may be wheeled along production lines to maintain quality of machines during their manufacture.

The flexible tube and focusing device of this 220,000-volt portable x-ray machine enable the apparatus to be aimed at welds in any position. L. D. Jennings, welding engineer at East Pittsburgh works of Westinghouse Electric & Mfg. Co., is shown focusing upon a weld in a steel transformer tank.

Shockproof, completely self-contained, ready for work wherever there is a proper power supply, it generates x-rays with a penetrating quality sufficient to pass through 3 in. of solid steel. The focusing mechanism on the new equipment is extremely flexible, so that the apparatus may be aimed at a weld or casting in either a horizontal or vertical position.

X-ray tube, transformer, capacitors, and flexible focusing device are all compactly mounted on a chassis with four balloon tires, automobile springs, and two-wheel mechanical brakes, enabling two men to move the apparatus in safety.

» «

All-Welded Riveting Machine

By W. E. ARCHER

★ Welding provided a large saving in construction of a riveting machine. This machine, as shown herewith, was welded at a cost of less than half that of a new factory-built unit, and is said to be just as efficient.

The frame was cut from ½-in. by 10-in. and ½-in. by 5-in. steel plates. A piece of 1-in. steel plate welded to the frame at the bottom formed the base. By use of the cutting torch, a slot was cut out for the operator's pedal. The lower section, or shelf, of the head piece was made from ¾-in. by 8-in. angle iron, while the upper section was fabricated of the same material, heated and bent to the proper shape for holding the drive shaft, which operates in a bronze bushing. Two pieces of angle iron, welded on the back of the frame, were used for securing the ½-hp. electric motor. Machine is driven by a V-belt.

A welded steel frame riveting machine built at a cost of about $100.

This job of welded construction was completed by J. G. Mehuron, of the Slauson & Santa Fe Avenue Welding Works, of Huntington Park, Calif. Mr. Mehuron states that the cast of the entire unit, including motor, did not exceed $100.

» «

Arc Welded Steel Frame For 12-Room Residence

★ In contrast with the average type of home which has been constructed with arc welded steel framing is the imposing residence shown in the illustration. This home has 12 rooms, two sun decks, an elevator and year-around air conditioning. The 96,000-lb. steel framework was welded throughout by the shielded arc process.

House beams are made from 2 x 2 x ¼ in. angle, top and bottom flange, with 1½ x 1½ x 3/16 in. lattice, welded in fixture at a speed of one foot of beam per min. Maximum beam span is 18 ft. Beams are 10 in. deep. Walls have 3-in. channel studs with ¾ in. lath channel welded on and covered with expanded metal lath. Wall channels are tied in to brick work with 1 in. x 1/16 in. galvanized strips welded to the far flange of the channel and brought into the brick work with a two-way bend to take care of differences in expansion of the steel frame and brick work.

Fig. 1—A modern 12-room residence built with arc welded steel framing at Wichita Falls, Texas.

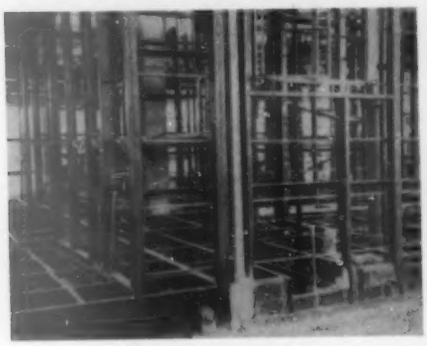


Fig. 2—Closeup of part of the arc welded frame.

A boom crane on the back of a truck handled and placed the shop-fabricated sections of the framework, some of which were three stories high. Fig. 2 shows a closeup of the arc welded frame. Photographs and information furnished by The Lincoln Electric Co.

» «

Welded Railing Used At San Francisco Bathing Beach

★ In San Francisco's new Aquatic Park, the visitor will find an impressive four-story bath house, with bleachers on each side for spectators. In front of this bath house stretches an 1850 ft. white sand beach, 60 ft. wide at high tide and 150 wide at low tide. A circular breakwater encloses an area about one-third of a mile in diameter. A welded railing extends entirely around the bleacher area. This welding job was done by J. Ketchum, a local welder, using a Hobart 200-amp. arc welder.

Mr. Ketchum is shown welding the top guard rail at the Aquatic Park bathing beach.

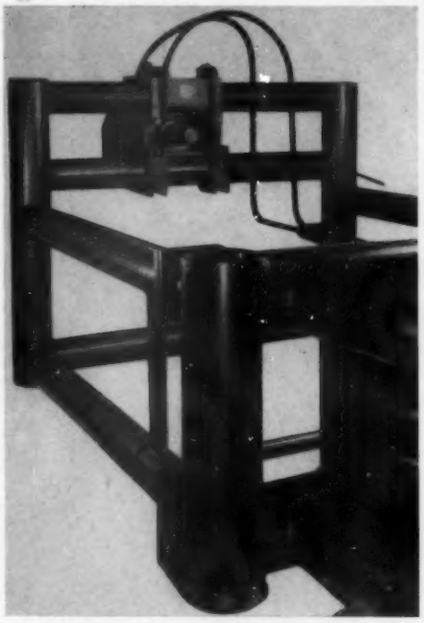
Standard Steel Pipe Used In Welded Bending Machine

By E. J. DeWITT*

★ A substantial saving in weight of steel was accomplished in the fabrication of a welded hydraulically-operated tube and pipe bending machine recently completed. A tubular design utilizing extra-heavy steel pipe accomplished a saving of 10,500 lbs. as compared to the previous design using structural shapes. The machine shown in the illustration weighed 49,000 lbs., whereas the previous structural design weighed 59,500 lbs.

Another outstanding advantage of the tubular construction was a reduction in maximum deflection under load from .031 in., for the structural design, to .013 in. In other words, the tubular design was more than twice as rigid, a factor which influences the accuracy of the machine. Comparative welding costs on the basis of weight of steel used in the frame worked out as follows: Structural design .069c per lb. of frame; tubular design .0665c per lb. of frame. The saving of weight in the frame was 27½ per cent. Another saving was accomplished in reduction of set-up time before welding. It was found that with tubular construction the frame could be set up in 23 per cent less time. As compared to a cast-iron frame we have estimated a weight saving of 35 per cent.

*Vice President and Chief Engineer, Wallace Supplies Mfg. Co., 1310 Diversey Parkway, Chicago, Ill.



More evidence of good pipe welding on the Wallace 49,000 lb. tube and pipe bending machine. A weight saving of 10,500 lbs. was accomplished in comparison with previous structural design.

The machine has a maximum bending capacity of 10 in. O.D. steel tubing or 8 in. standard steel pipe. With this machine it is possible to make bends up to 180 deg. in one continuous operation. Clamping of tubing or pipe, pressure, and mandrel operation are handled automatically through the hydraulic mechanism. The operator controls all movements by means of three valves.

It would have been impossible to build this machine other than by welding with the equipment available in the shop. The contract for this equipment incorporated a 60-day penalty clause which we were able to meet with a safe margin. We obtained permission to redesign the equipment from the previous structural design to the tubular design, otherwise we would not have been able to meet the 60-day delivery date.

Attention should be attracted to an important feature of this machine; namely, that it permits cold bending without developing wrinkles in the pipe or tubing and without inserting any filler material inside the pipe. This "wrinkle-free" bending is accomplished by the patented design of the bending gear.

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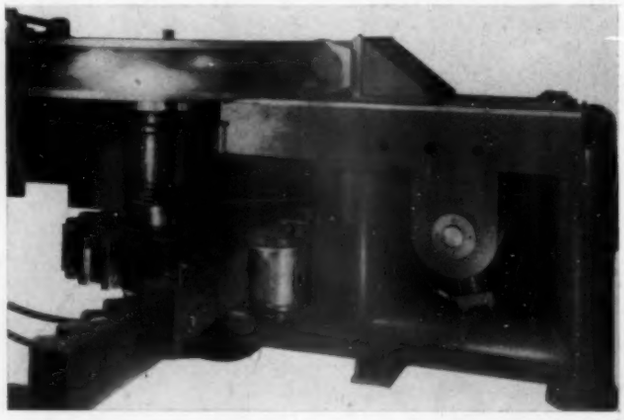
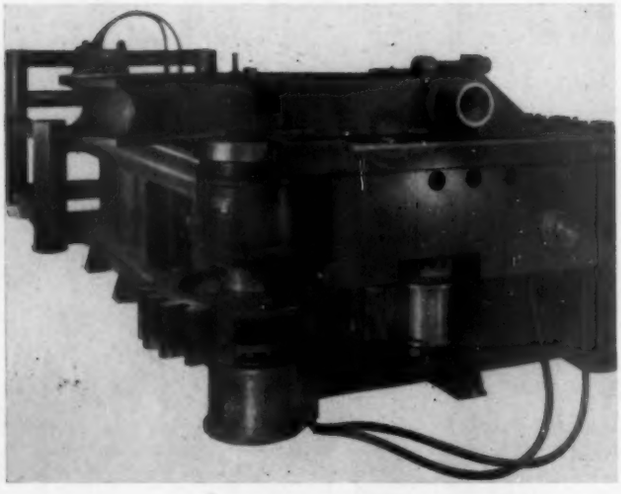


Rack and pinion drive which operates the pipe bending gear at top of machine. Standard pipe sections used for major structural members.

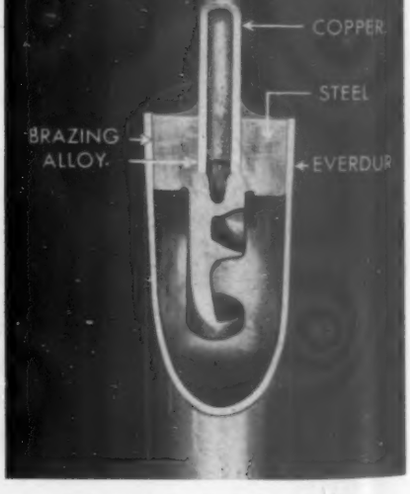


An end view of the Wallace pipe bending machine. Welded tubular construction gives greater rigidity under load than former design employing conventional structural shapes.

Joining Everdur to Steel to Copper

★ Among the features which are creating interest in low-temperature silver brazing is the ability of certain alloys of this type to make reliable joints between dis-similar metals. An illustration shows a good example. This is a cut-away section of an electric refrigerator part made up from Everdur, steel and copper.

The outer shell of Everdur is brazed to a steel center section, which is joined to a copper tube. The alloy used is a low-temperature composition having a medium silver content, known as Easy-Flo, made by Handy & Harman. The work is done at a low temperature of 1175 deg. F., using a flux that is active at 1100 deg. F. The high strength of the bond and also its ductility make the completed assembly as sound and gas-tight in service as a solid piece of metal.



Joining of dissimilar metals is easily done with Easy-Flo, a low temperature silver brazing alloy.

Welded Snow Plows

★ Remembering the back-aches attendant upon clearing a lot of snow by the shovelful, William Kutassy, who operates a welding shop in Schenectady, N. Y., built himself a snow-plow from odds and ends of materials he had around the shop. He built it so that it could easily be attached to the front bumper

Simple design of welded snow plow built by Wm. Kutassy, Schenectady, N. Y.

of one of his regular welding trucks. The entire plow was fabricated by arc welding using a General Electric gasoline-engine-driven arc-welder. When the heavy snows came last winter, Mr. Kutassy's plow worked so efficiently that he decided to drum up business among local gas stations which could use such equipment.

» «

4,000 Lbs. of Thermit Used On Welded Punch Press

By GEO. H. RICHARD*

★ We recently completed a thermit welding job on a broken frame for a Hillis & Jones punch and shear. The customer was using this machine night and day in cutting railroad tie plates. Due to overloading the machine, the frame broke through the throat of

After 4000 lbs. of thermit was used to repair the broken press frame.

the press and down both sides, the total length of the break being 10 ft. One-third of the break was in a section 10 in. thick (across the throat of the press) while at the sides, the thickness of the break tapered down from 10 in. to 4 in. When stripped of accessory parts, this cast steel frame weighed about 15 tons. As far as we know it is the largest job of thermit welding ever handled on the West Coast, and we have been handling thermit welding jobs for the last 25 years.

*President and Manager of Ferrofix Brazing & Machine Works, Seattle, Wash.

Set up of equipment before igniting the thermit. Four 1000-lb. crucibles were used.

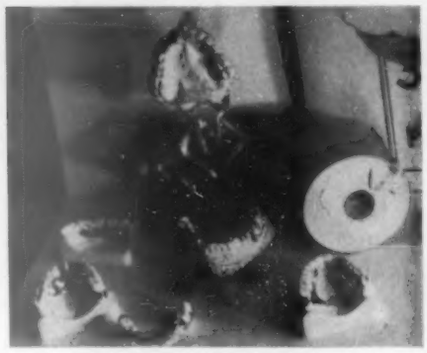
One photograph shows the set-up of equipment before igniting the thermit. We used about 4,000 lbs. of thermit, using four 1000-lb. crucibles. Substantial reinforcing pads were added on the inside and outside of the casting to develop greater strength. This was a hurry-up job, as most of them are, the welding being completed in ten days. The machine was placed back in service in two weeks.

» «

Welding Torch Aids In "Dental Restoration"

★ Just in case you may not know it, it is now possible to have your dentist fit you with a chrome alloy removable bridge. That is, if your own teeth have failed you, and your dentist prescribes synthetic teeth to take their place. Durallium is the name of one type of chromium-cobalt alloy being used by the dental profession in making removable bridges. This new alloy weighs about 1/3 as much as gold, thus affording greater comfort to the patient. It is said to be immune to nearly all acids and alkalis and possesses a high degree of resistance to oxidation. Durallium dental alloy can be given a mirror-like lustre by polishing. It has about the same ductility as gold. Table 1 lists the important physical properties of this alloy.

Durallium alloy is melted with an oxy-acetylene torch in a small crucible.



A few Durallium restorations to show types of applications.

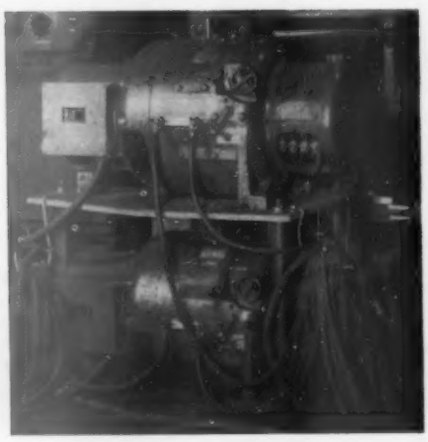
TABLE 1—PROPERTIES OF DURALLIUM DENTAL ALLOY

Melting point	2460 Deg. F.
Specific gravity	8.23
Brinell hardness	265-280
Elastic limit	55,000 psi.
Tensile strength	93,000 psi.

In addition to chromium, this alloy contains cobalt, tungsten, molybdenum, nickel, columbium, and a small percentage of other elements. It is made in a high-frequency electric furnace, using a hydrogen atmosphere.

After a proper mold has been prepared, the dental technician employs an oxy-acetylene torch to melt the Durallium alloy in a small crucible placed in a centrifugal casting machine. Fig. 1 shows Mr. Wilk of the Joseph R. Wilk Dental Laboratories, 185 N. Wabash Ave., Chicago, using a Torchweld Style 5SL torch (No. 6 tip) to make a dental casting.

Examples of "dental restorations" are given in Fig. 2 to show the diversity of applications. In case of repairs or additions on the restoration, Durallium may be soldered with a special solder.



Two Westinghouse arc welders, mounted one on top of the other to save floor space.

New Product Developments

New Wilson d-c. arc welder rated at 150 amp. (25 volts) has a range from 20 to 200 amp.

Wilson Introduces New 150-Amp. D-C. Arc Welder

★ A new d-c arc welding motor-generator set, with a rating of 150 amp. at 25 volts, and having a range of adjustment from 20 to 200 amp. at 25 volts, has been introduced by Wilson Welder and Metals Co., Inc., New York City.

Current control on this new welder consists of a three-point current switch and a dial rheostat control for fine adjustment. Smoothness and precision of adjustment make it possible always to get the right current, and enhances the adaptability of the machine to all types of electrodes, from bare to heavily coated. Open circuit voltage is from 40 to 75 volts. The set will use electrodes up to 3/16-in. Standard wiring is for 3-phase, 220 or 440-volt. 60 cycle power supply.

Welding qualities claimed for this welder include a steady arc, quick voltage recovery, welds without current surges, and stability of the arc when welding on thin sections.

The portable model, equipped with strong rubber-tired casters, is 12 in. by 26⅜ in., stands 23⅝ in. high, weighs 338 lbs. The stationary model, without casters, weighs 8 lbs. less. The new welders are sturdily built for continuous production service, and attractively finished in yellow.

» «

Welding Helmets and Hand Shields

★ Four new welding helmets and four new hand shields have been announced by American Optical Co., Southbridge, Mass. These helmets and hand shields are made of vulcanized fibre, in either fabricated or one-piece construction, and are designed for comfort, safety, convenience and durability.

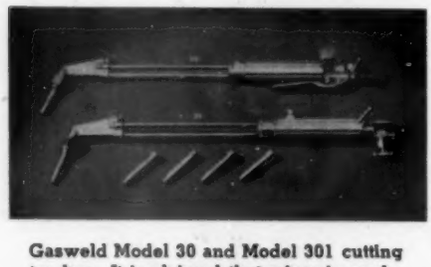
The helmets have a new free-floating headgear and an outside friction joint as standard equipment. Three types of glass holders are available: deep-drawn leak-proof steel, improved bakelite, and a new Dowmetal lift front, all of which assure protection for welding plates and cover glass. An exclusive feature is noted in these holders—they secure the welding and cover glass in position flexibly, not rigidly, in order to cushion the shock if accidentally struck.

The hand shields are compact, lightweight, and well-balanced. Corrugated fibre handle, of new design, is deeply grooved to insure a firm, positive grip.

» «

Gasweld Cutting Torch

★ Gasweld Equipment Co., 625 W. Jackson Blvd., Chicago, Ill., has introduced two new models of Gasweld cutting torches. Model No. 30 is a button-type, while Model No. 301 is a lever-type torch. A triangular tube construction is employed on both models. The needle valves have monel metal parts. The head is of forged bronze and the tubes are of nickel alloy. It is stated that the



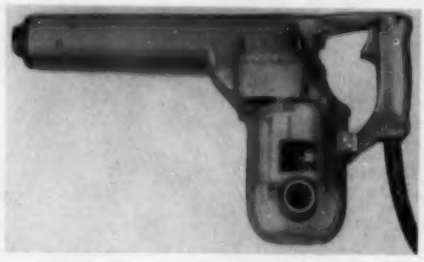
Gasweld Model 30 and Model 301 cutting torches. It is claimed that mixer is so designed as to eliminate flashback.

mixer is so designed as to eliminate flashback. A feature of the Gasweld torch is the straight line high-pressure valve designed for quick opening and delivery of high-pressure oxygen to the cutting jet. A ribbed handle of seamless brass tubing is used. The manufacturer can supply acetylene tips from Nos. 1 to 5 inclusive and also special tips for oxy-hydrogen or oxy-butane cutting.

» «

Portable Electric Hammer

★ The Black & Decker Mfg. Co., Towson, Md., announce the redesigning of their No. 34 portable electric hammer to increase motor power efficiency. This tool, like the other Black & Decker portable electric hammers, is a completely self-contained unit which is powered by a universal motor and requires no transformer, rectifier or other equipment. There has been no change in the operating principle of the tool, the action being developed by an oscillating weight and spring assembly, the weight driven indirectly by a crank.



Black & Decker No. 34 portable electric hammer.

This tool weighs only 17 lbs., develops 2300 blows per min. and has a capacity in concrete or brick of 1⅛ in. It is especially useful for drilling and channeling in concrete, stone or brick; removing form marks from concrete surfaces; caulking joints and seams in tanks, etc.

» «

New Wilson 100-Amp. A-C. Arc Welder

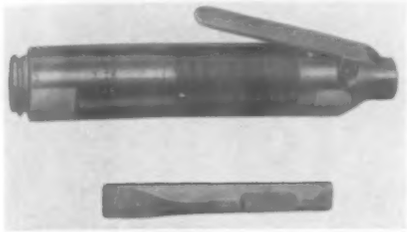
★ Wilson Welder and Metals Co., Inc., New York City, have a new arc welder of 100-amp. rating at 30 volts for light sheet metal welding and other light work requiring low current. The new machine is of the a-c. transformer type, and designed especially for use with heavily-coated electrodes. Standard wiring is for single-phase, 220-volt, 60-cycle power supply, but it can be furnished for 440-volt supply if desired. Open circuit voltage is 65 volts. A calibrated scale on the front of this welder indicates the current adjustment, which is from 25 to 150 amp. This control of current is continuous by rotating a crank at the top. Because the circuit is not broken, there is no need to stop operations and open any connections while a change of welding current is being made. The continuous adjustment makes it possible to "tune" the current exactly to suit the thickness and welding characteristics of the material. A-c. welders of this size have been found to give best performance when electrodes made especially for a-c. welding are used. The company recommends Wilson No. 520 with this model. It will handle diameters up to 5/32-in.

Enclosed in a sheet metal housing 6½ in. in diameter and 24 in. high, weighing 145 lbs., the new welder is a compact and mobile unit.

Wilson 100-amp. a-c. arc welder designed for sheet metal welding and other light work.

Weld-Flux Chipper

★ Chicago Pneumatic Tool Co., 6 E. 44th St., New York City, has developed a special tool known as the Weld-Flux Chipper, for removing flux from arc welding operations. A feature of this pneumatic chipping tool is a novel blowing device which blows away the flux or metal chips. A lever-type throttle is employed and also a safety retainer to hold the chisel in place. This chipping tool weigh 2 lbs. and is said to be extremely fast and smooth in operation. Overall length, without the chisel, is 7½ in. A special peening chisel can also be used.



Pneumatic chipping tool for removing flux from arc welded joints.

» «

Spot Welding With Hydrogen Gas Atmosphere

★ A spot welding machine equipped with an automatic hydrogen gas economizer is employed for welding molybdenum, nickel or other similar metals. In order to prevent oxidation, hydrogen gas in introduced at the time of welding. The flow of hydrogen is directed to the spot where the welding takes place.

The automatic gas economizer and shut-off valve are so arranged that immediately after the weld is completed, the gas is cut and thus burns only during the actual welding operation. When the welding tips make contact with the work and a weld is made, the valve permits a small amount of gas to ignite right over the spot of the weld.

This hydrogen flame prevents material from becoming brittle. This machine is in use where fine molybdenum wires are welded to heavy tubes. These machines are made in sizes from 5 to 250 KVA. by Eisler Engineering Co., 750 So. 13th St., Newark, N. J.

Spot welder is equipped with automatic device for directing stream of hydrogen at parts being welded.

» «

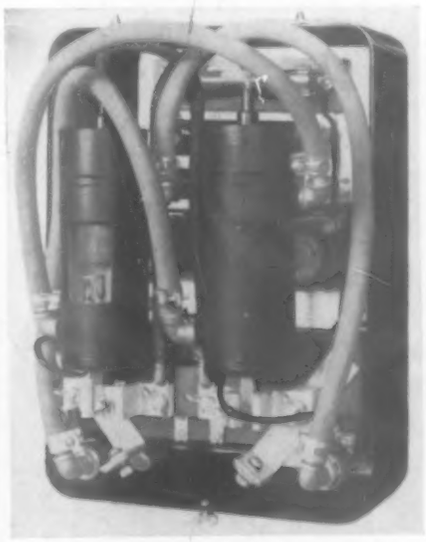
Greyhound A-C. Arc Welder

★ Torchweld Equipment Co., 1035 W. Lake St., Chicago, have recently added the Greyhound A-c. arc welder to their line of oxy-acetylene equipment and welding accessories. The units are constructed according to N.E.M.A. specifications and feature a fan cooling system for dissipation of heat. Two sizes are available with currents ranging up to 250 and 350 amps. respectively. Several heat stages make it possible to select the proper welding current for various operations. Power supply required is 220 volts a-c.—50 or 60 cycles. Further details can be obtained from Torchweld Equipment Co.

» «

Adds to Line of Ignitron Contactors

★ General Electric has a new addition to its line of ignitron contactors for spot projection and flash welders. The new contactor offers such advantages as quiet operation, no moving parts and low initial as well as low maintenance costs. In addition, the ignitron tubes can be replaced quickly. The new device will be of interest to operators faced with high-speed welding applications, such as manufacture of automobile bodies or fabrication of other sheet-metal products.



Ignitron contactor for resistance welding has no moving parts and is quiet in operation.

General Electric ignitron contactors are now available, with or without enclosing cases, in the following ratings, based on typical welding duty cycles: 150, 300, 900, and 2500 amp.

The new contactor consists of two water-cooled, sealed-off ignitron tubes mounted on a composition panel with the control circuit. The tubes are so connected as to conduct full-wave a-c. current to the welding machine when the control switch is closed. Current flow ceases when the control switch is opened. Any type timer can be used to control this contactor.

A new G-E flow switch, of the differential-pressure type, assures adequate water cooling when the control is in operation.

» «

Industrial Face Shield

★ The Boyer-Campbell Co., 6540 Antoine St., Detroit, Mich., has developed its No. 10 Face Shield for the protection of industrial workers from dust and dirt particles. The shield is of light weight and fits snugly. The plastacele window buttons to the head band and is easily removable. Genuine leather sweatbands, backed with wool felt, are said to promote wearing comfort. No metal touches the head and it is claimed that because of this feature the wearer is not troubled with headaches caused by static electricity. The window can be tilted up when not in use. The plastacele windows are available in three colors: clear, amber or green. These face shields have found considerable application in resistance welding shops to protect operators.

Face shield has removable plastacele window and genuine leather sweatband.

» «

Lincoln Electrode For A-C. Transformer Welders

★ A new arc welding electrode for use with a-c. transformer type welders which have low open-circuit voltage is announced by The Lincoln Electric Co., Cleveland, Ohio. The new electrode, known as "Readyweld," is a low-carbon steel rod with a heavy extruded shielded arc coating possessing properties which assure arc stability and easy re-striking of the arc with small low-voltage transformer welders.

"Readyweld" is intended for general welding and repair work on light gauge sheet steel. The electrode provides weld metal which possesses high strength and ductility. Because of its desirable arc characteristics, the elcetrode permits easier and better welding in the type of work for which it has been developed. Although designed primarily for use with a-c. transformer welders of low open-circuit voltage, "Readyweld" also operates well with d-c. reverse polarity. The electrode is manufactured in 3/32 in. dia., 12-in. lengths, packed in 25 lb. containers.

Pneumatically-Operated Welding Lens

★ The illustration shows a simple device which has been developed to aid the arc welder. This device attaches to the welder's helmet and through the medium of a tube held in the welder's mouth, the colored welding lens can be raised or lowered. This

Welding lens can be raised or lowered by control of tube held in welder's mouth.

permits the welder to raise the welding lens when he wishes to inspect, clean or chip the weld. The device is claimed to be sanitary, because extra tubes and mouth pieces are supplied with each unit, so that a number of welders may use the same helmet. The device is sturdily constructed but light in weight. Further information can be obtained by writing to the manufacturer, S. W. Duncan, 408 S. Hoyne Ave., Chicago, Ill.

» «

CIG Develops New "Ready Fluxed" Bronze Rods

★ Compressed Industrial Gases, Inc., Chicago, Ill., announces two new bronze welding rods. These rods are known as CIG "Ready Fluxed" Bronze Rods and, as their name implies, they are completely flux-coated throughout their entire length, ready for the oxy-acetylene welder to apply. This improvement in bronze welding rods is stated to be more than an innovation. It is claimed to be the most important step that has been made recently in bronze welding rod manufacture, because it controls the introduction of the chemically correct flux throughout the brazing operation. It prevents the weld from getting too much or too little bronze and completely shields the molten metal from the time the weld area is first tinned until the job is completed. The welder does not have to waste time and gases while he reaches for his powdered flux can. With the CIG Ready Fluxed Bronzes his brazing operation will be a continuous process. It has been estimated that a 15% saving in operators' time is effected and over a 15% saving in gas consumption.

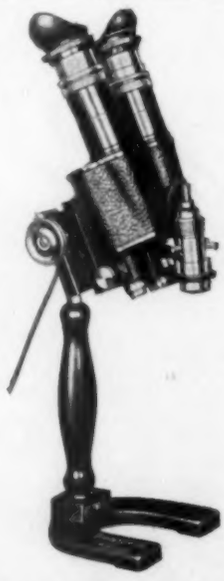
CIG Ready Fluxed Bronzes are doubly deoxidized with the result that brazes made with these rods are virtually fumeless. The chemically correct flux on these rods will keep the molten metal in a semi-plastic condition, which enables the operator to apply the bronze in any position with ease. The CIG Ready Fluxed bronze rods are designed for application to any type of bronze welding. Ready Fluxed bronze rods are made by CIG's subsidiary, Hollup Corp., Chicago.

Dense grain structures and high-tensile strength welds are easily and consistently made. Actual tests of weld specimens are said to reveal physical qualities superior to welds made with uncoated bronzes and ordinary powdered fluxes. The ductility and elongation is increased from 21.75% to 30.1% and tensile strength has been increased from 50,150 lbs. to 58,500 lbs. in standard .505 in. test specimens. In bronze applications where powdered flux is used, it requires approximately 1 lb. of flux for each 25 lbs. of bronze deposited. Sizeable savings can be attained in the cost of the product. In addition, savings may be effected in time, labor, oxygen and acetylene.

» «

Visual Inspection of Welds With Binocular Prism Magnifier

★ A new optical instrument is being offered by E. Leitz, 730 Fifth Ave., New York City. This device, known as the Leitz Binocular Prism Magnifier, is designed for use in the visual examination of welds, either in the laboratory or shop. It is claimed that with the Leitz instrument welds can be examined to determine cracks, penetration and porosity which would otherwise be invisible. With this tool it is possible to maintain control over welding at any stage in the production set-up. Among the advantages claimed for the Leitz Binocular Magnifier are: (1) Visual properties of both eyes utilized; (2) Eyes are not overstrained; (3) Realistic images are produced; (4) Objects stand out in natural relief; (5) Long working distance; (6) Detachable horseshoe foot can be removed so that magnifier can be placed at an angle on welded parts difficult of access.



Leitz binocular prism magnifier for weld inspection.

Small Arc Welder Has Dual-Continuous Control

★ A small motor-generator type arc welder, said to provide greater convenience and accuracy in welding because of a new self-indicating dual-continuous current control, is announced by The Lincoln Electric Co., Cleveland, Ohio.

Because of its advanced features and moderate price, this unit is expected to widen the application of welding in new fields such as garages, bus and truck fleet repair shops, sheet metal shops, maintenance departments of pulp and paper mills, paint mills, cement

Small motor-generator type arc welder with self-indicating dual-continuous control of voltage and current

plants, textile plants, gas plants, and similar plants in the process industries, as well as metal fabricating shops, piping work, etc.

The welder, known as the "SA-150," has both job selector and current control calibrated and equipped with dials which indicate the type of work and number of amperes for each and every setting. It is claimed that this development enables the welding operator to secure high quality welds and high welding speeds because he can vary both the slope of the volt-ampere curve and the amount of welding current independently.

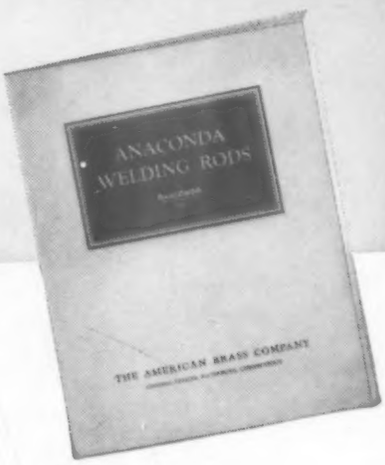
The welder's current range of 45 to 200 amp. fits it for sheet metal work, hard facing of many types, pipe welding, cast-iron repair, garage work, fit-up and auxiliary work in shops where general welding predominates, regular production welding involving steel, alloy and non-ferrous plates and shapes.

The "SA-150" is powered with a "Linc-Weld" squirrel-cage induction motor for across-the-line starting. Connections are readily accessible for either 220 or 440 volts, 3 or 2-phase, 60 or 50 cycles as desired.

Construction is arc welded drip-proof steel. Four steel feet welded to the base and drilled permit bolting the welder in stationary installations, or attaching the optional three-wheeled running gear. Floor space occupied is less than 4 sq. ft. Increased use of welding has also been furthered by making similar machines in 75 and 100 amp. sizes.

"Don't scrap it—restore it by Tobin Bronze Welding"

This cast-iron valve casing cracked all around and would have been scrapped had it not been restored to service by means of Tobin Bronze welding.



Write for this booklet—For detailed description of Tobin Bronze, write for free copy of Publication B-13. This booklet describes the entire series of Anaconda Welding Rods . . . their tensile strengths, weights, melting points, composition, etc. It also tells which rod is best suited to different types of welding.

MELTING POINTS OF ANACONDA WELDING RODS

Material	Approx. Melting Point—Degrees		Material	Approx. Melting Point—Degrees	
	Cent.	Fahr.		Cent.	Fahr.
Tobin Bronze*	885	1625	Phosphor Bronze E	1070	1958
Anaconda 520	885	1625	Phosphur Bronze D	1000	1832
Manganese Bronze	870	1598	Phosphor Bronze C	1025	1877
Anaconda 997 (low fuming)	870	1598	Silicon Copper	1083	1981
Brazing Metal	930	1706	Deoxidized Copper	1083	1981
Economy Bronze*	885	1625	Electrolytic Copper	1083	1981
Everdur*	1019	1866	Super Nickel	1225	2237
Phosphor Bronze A	1050	1922	Nickel Silver	1055	1931

*Trade-marks Reg. U. S. Pat. Off.

In the repair of broken castings, this Anaconda Welding Rod saves countless dollars for industry

Welders the country over are doing "impossible" jobs with the aid of Tobin Bronze. This low melting point Anaconda Rod enables welds to be made in one-third to one-half the time required when extensive pre-heating is necessary. Particularly on cracked and broken cast-iron parts, time and money can be saved, shutdowns avoided, production and payrolls maintained.

Tobin Bronze—time-tried Anaconda product—makes dependable welds quickly, at low cost. Railroads, for instance, find it invaluable in maintenance work. Tobin Bronze carries the trade-mark "Tobin Bronze Reg. U.S. Pat. Off." on each rod. Look for this trade-mark, make certain you are getting *genuine* Tobin Bronze!

89129

ANACONDA from mine to consumer

Anaconda Welding Rods

THE AMERICAN BRASS COMPANY, General Offices: Waterbury, Connecticut

In Canada: Anaconda American Brass Ltd., New Toronto, Ont. • *Subsidiary of Anaconda Copper Mining Company*

News of the Industry

PROGRAM OF FIFTH ANNUAL WELDING CONFERENCE

University of Kansas, Lawrence, Kans., April 13-14th

Structural Steel Welding
By ARTHUR N. KUGLER, Air Reduction Sales Co.

Unionmelt Welding Process
By F. C. HUTCHISON, Linde Air Products Co.

Machine Design and Structural Design for Arc Welded Construction
By E. W. P. SMITH, Lincoln Electric Co.

Recent Developments in Welding
By W. M. B. BRADY, General Electric Co.

Strength of Materials
By Professor A. M. OCKERBLAD, University of Kansas.

Arc Welding as an Industrial Tool
By Professor W. W. CARLSON, Kansas State College.

Hard Surfacing
By THEODORE B. JEFFERSON, Marine Design Section, Office of Chief Engineer, War Department, Washington, D. C.

Pipe Line Welding
By ORVILLE "MIKE" MAUCK, Sinclair Refining Co.

Fabrication of Monel, Nickel and Inconel; and Nickel-clad and Inconel-clad Steels
By F. P. HUSTON, International Nickel Co.

Dinner on Thursday evening, April 13th—Speakers:
DEAN I. C. CRAWFORD, University of Kansas.
K. L. HANSEN, District Vice-President, A.W.S.

» «

A.S.T.M. COMMITTEE ON STEEL—As a result of a series of meetings of Committee A-1 on Steel and several of its subcommittees held in Columbus, Ohio, recently, several new specifications are to be submitted to letter ballot and other important actions involving committee standardization work will be taken. A further effort will be made to consolidate specifications covering mild steel plates (A 10) and steel plates for forge welding (A 78), a report being expected at the June, 1939 meeting. The need for standardized requirements for structural bolt steel resulted in the decision to appoint a section to draft recommended requirements. There was extended discussion on the possibility of consolidating the specifications for steel for bridges (A 7) and for buildings (A 9). A report at the March meeting on a proposed change in the title of (A 7) with definite scope clauses to be added to both specifications was considered and finally it was decided to study further the possibility of a consolidated specification.

SUBCOMMITTEE IX ON STEEL TUBING AND PIPE—Possibly the most interesting of the items was the approval subject to ballot of new specifications covering alloy-steel boiler and super-heater tubes, developed by a special section headed by NEWELL D. HAMILTON, Babcock & Wilcox Co. Thirteen grades of material are set up, nine of which are ferritic and four austenitic types, the minimum tensile strength for the ferritic, 60,000 psi.; for the austenitic, 75,000 psi., with respective yield points of 25,000 and 30,000 psi. This proposed specification will be published in the 1939 report of the Steel Committee prior to the June, 1939 meeting. Action was taken also to recommend new specifications for electric-resistance welded heat-exchanger and condenser tubes. Electric-resistance-welded steel boiler tubes for high-pressure service are expected to be covered shortly in another new specification.

SUBCOMMITTEE XI ON BOILER STEEL—A proposed combination of specifications covering carbon-silicon steel plates (A 149) and (A 150) was approved, two grades being set up: one, requiring a tensile strength of 65,000 to 77,000 psi.; the other, 70,000 to 82,000 psi. This specification covers material up to 4½ in. in thickness but not exceeding 25,000 lb. theoretical weight for plates of over 4½ in. thickness. The specification is in wide use in the pressure vessel field, locomotive boiler shells, boilers for stationary service, etc.

» «

COORDINATING COMMITTEE ON CORROSION—A number of technical societies and other organizations engaged in the study of corrosion have joined in forming the American Coordinating Committee on Corrosion, which is to serve as a clearing house and coordinating agency for experience and work in progress in the field of corrosion and corrosion prevention. As its first step the committee is compiling a list of the names and addresses of those working in the field of corrosion in this country, together with information as to their special interests and their current programs of corrosion studies.

» «

CARNEGIE INSTITUTE OF TECHNOLOGY, Pittsburgh, Pa., in cooperation with the Westinghouse Electric & Mfg. Co., has begun a search for the second group of 10 boys who will be trained as engineers under a five-year "work-learn" study program, made possible by the Westinghouse Co. in conjunction with its $200,000 appropriation to the Institute in 1937.

The cooperative engineering educational plan, which enables the student to obtain practical experience in Westinghouse plants during five summer vacations and two college semesters as well as to complete eight semesters of college class work, was launched last summer with the selection of the first 10 scholarship students.

Future Meetings

May 3-5, 1939
American Institute of Electrical Engineers, 33 West 39th St., New York City.
Northwestern District Meeting at Springfield, Mass.

May 11-12, 1939
Ohio State University, Eighth Annual Welding Engineering Conference will be held in the Industrial Engineering Building on the University Campus, Columbus, Ohio.

June 26-30, 1939
American Institute of Electrical Engineers, 33 W. 39th St., New York City.
Combined Summer and Pacific Coast Convention at San Francisco, Calif.

July 10-14, 1939
American Society of Mechanical Engineers, 29 W. 39th St., New York City.
Semi-Annual Meeting at San Francisco, Calif.

October 23-27, 1939
American Welding Society will hold its annual meeting at the Stevens Hotel, Chicago. American Society for Metals, and other cooperating technical societies will meet during the same week in Chicago. Headquarters of the A.S.M. will be at the Palmer House.

The 1939 National Metal Congress and Exposition will be held the same week in the International Amphitheatre, 4200 S. Halsted St., Chicago.

Discussion on Radiography

(Continued from page 24)

the most critical joints to be x-rayed. In that way, and by employing proper means and ways of doing the job, x-ray inspection is reasonable and worth while.

PAGE 957—Welded joints in piping and fittings can be subjected to x-ray inspection inasmuch as the work can be carried out satisfactorily in the shop as well as in the field. Thus the quality of these joints is checked beyond doubt, and where the importance of sound welds is paramount, x-ray inspection should be made mandatory.

PAGE 1063—The same may be said for welded fuselage structures and other welded airplane parts. This is equipment where human lives depend on structural integrity. No means should be spared to assure perfect workmanship and sound materials. Since some work has been done along these lines by inexperienced operators, using unsuitable x-ray equipment, the opinion seems to be prevalent that x-rays canont be used for this work. That this is not the case is indicated by the fact that there is practically no aircraft manufacturer in Europe who does not have x-ray facilities available. Our aircraft manufacturers should do likewise.

Personals

DONALD J. RIDDELL, former General Electric Co. (Philadelphia Works) welding specialist has been appointed Eastern district representative for Progressive Welder Co. Mr. Riddell's territory will include all states east of Ohio. His headquarters will be at 2308 Chestnut Ave., Ardmore, Pa.

» «

A. J. AUERLICH, identified with Progressive Welder Co. in the development of the

first hydromatic welder, and for the last four years in the company's Detroit sales and service division, has been transferred to Dayton, Ohio. He will handle sales for the company in both Ohio and Indiana, with headquarters at 503 Callahan Bldg., Dayton, Ohio.

» «

E. L. MATHY, vice-president, Victor Equipment Co., San Francisco, Calif., is president of the newly organized Northern California Chapter of the National Industrial Advertisers' Ass'n. Formal presentation of the N.I.A.A. charter was made by R. P. DODDS, vice-president of the national N.I.A.A. organization on March 9th.

Trade News

ORDERS RECEIVED BY GENERAL ELECTRIC CO. in the first quarter of 1939 amounted to $86,882,953, compared with $65,376,400 for the corresponding period in 1938, an increase of 33 per cent.

» «

THE NATIONAL PURCHASING AGENTS ASSOCIATION will again sponsor an "Inform-A-Show" this year which will be held at the Fairmont Hotel, in San Francisco, Calif., from May 22nd to 25th. Air Reduction Sales Co. and its affiliated organizations will participate with an exhibit in Booth 149. Airco will display a complete line of its atmospheric gases as well as a wide range of welding and cutting equipment. The No. 10 Radiograph will be included in the display.

THE WILSON WELDER AND METALS CO., INC., will show, in addition to its complete line of electrodes and accessories one of its type "SA" motor-driven arc welding machines. NATIONAL CARBIDE CORP. will display "National" Carbide in the Red Drum and Carbide Lights.

» «

THE McKAY CO., manufacturers of McKay tire chains, McKay commercial chain, and McKay arc-welding electrodes, are transferring from their Pittsburgh office, their general sales, order, invoicing, and purchasing departments to their York, Pa., plant. This move is being made in order to expedite the handling of orders, inquiries, and invoicing. The executive departments and a district sales office will remain in the McKay building, 1005 Liberty Ave., Pittsburgh, Pa.

» «

UNITS OF U.C.C. TO EXHIBIT AT COAL EXPOSITION—The Linde Air Products Co., National Carbon Co., Inc., and Haynes Stellite Co., will exhibit jointly at the 1939 Coal Convention and Exposition of The American Mining Congress, the Music Hall, Cincinnati, Ohio, April 24 to 28. The Linde Air Products Co. will exhibit welding and cutting blowpipes and various applications of the oxy-acetylene process that contribute to economical operation in the coal mining industry. HAYNES STELLITE CO. will exhibit the application of Haynes Stellite and Haystellite to coal undercutter bits.

» «

THE LIQUID CARBONIC CORP. of Chicago has completed negotiations for the purchase of assets and business of Wall Chemicals,

What more can you ask in a brazed joint!

STRENGTH

Sil-Fos and Easy-Flo brazed joints are stronger than the metals joined. Under breaking tests the metals joined give way —not the joints.

DUCTILITY

Bend, twist, hammer and pound Sil-Fos or Easy-Flo joints—the silver in them makes ductile joints that are practically indestructible.

LEAK-TIGHTNESS

Turn on pressure — the metal will let go without a leak or break in the joint. Free-flowing Sil-Fos and Easy-Flo penetrate to every crevice — make leak-tight joints.

LOW COST

Thin films of Sil-Fos or Easy-Flo make the best joints. Fast application, less labor, gas and finishing expense contribute further to low costs.

ONE INCH of ⅛" wire — costs but a fraction of a cent

If you are not using Sil-Fos or Easy-Flo, write for Bulletins W-5, 9 and 10.

HANDY AND HARMAN

HANDY & HARMAN FOUNDED 1867 QUALITY SERVICE

82 Fulton St., New York, N. Y.

Agents in Principal Cities

In Canada: HANDY & HARMAN of Canada, Ltd., Toronto

Inc., with plants in Chicago, Detroit and Buffalo, according to an announcement made by C. R. CARTER, Liquid Carbonic vice-president. Terms of the purchase have not been made known.

The purchase marks the extension of Liquid's operations in the compressed gas industry. Wall Chemicals manufactures oxygen, acteylene and other compressed gases.

The business will be conducted by Liquid Carbonic as Wall Chemicals Corp., a wholly-owned subsidiary with headquarters in Detroit. A. F. WALL, as president and general manager, will be in full charge. He has had more than 15 years experience in this business.

» «

MAURATH MAKES RUSH SHIPMENT TO ARABIA—George A. Maurath, president of Maurath, Inc., 7309 Union Ave., Cleveland, Ohio, received a cablegram a few weeks ago from a European customer requesting a rush shipment of 3500 lbs. of stainless electrodes. Mr. Maurath states that completion of this order from raw materials to finished product required 24 hour a day service of practically every man and machine in the plant for two days. Shipment was loaded on a truck and dispatched to Brooklyn, N. Y., arriving just 55 min. before sailing time.

» «

PIPE-WELD, INC. is the name of a recently organized company engaged in the manufacture of fusion welded piping for both high and low pressure service. The company is located at 2628 S. Sacramento Ave., Chicago. Through an error, the address of the company was incorrectly stated as 1825 W. 16th St., in the March, 1939, issue. A. B. SLATTERY is president, F. H. CARPENTER, vice-president, C. O. LARSON, sales manager, and O. C. RUDY, secretary-treasurer.

Construction

WELDED PIPING, a welded steel building, and an installation of welded equipment feature a project just recently started by BECHTEL-MCCONE-PARSONS, Los Angeles contractors. They are building a cold acid-testing plant at the Watson refinery of the Richfield Oil Corp.

» «

HUMBLE OIL & REFINING CO., Houston, Tex., plans construction of a 56-mile, 8-in. pipeline to serve the new Kelsey field, in Jim Hogg County, Texas. Cost of line is estimated at $500,000. This company has also entered an agreement with operators in the Flag Lake field to construct a 25-mile oil line from Mildred, in Navarro County, to the Flag Lake field.

» «

CONSTRUCTION OF A 30-MILE, 4-in. welded distillate oil line from the Agua Dulce field, of Neuces County, Tex., to Corpus Christi, has been started by the Corpus Christi Corp. Williams Brothers Corp., of Tulsa, Okla., has been awarded the contract.

» «

THE EL PASO NATURAL GAS CO. is laying a 190-mile welded pipeline west from Gage, near Deming, N. M., through Duncan, Safford and Globe to Miami, Ariz. The line will carry natural gas to the Miami Copper Co. and other mine operators in that territory.

» «

THE LOCKHEED AIRCRAFT CORP. of Burbank, Calif., is building a 50 by 220-ft. addition to its plant at Empire Ave. and Victory Place, using welded structural steel. Pacific Iron & Steel Co., of Los Angeles was awarded contract for steel construction.

THE NATIONAL TANK & MFG. CO., Los Angeles, Calif., has been awarded a contract for construction of a 41 by 204-ft. welded steel building for Peerless Pump Co., at 301 West Avenue 26, in Los Angeles.

» «

THE LOUISIANA-NEVADA TRANSIT CO. has made application for an 8⅝-in. welded gas line from Cotton Valley oil field in Webster Parish, La., to the plant of Ideal Cement Co., in Howard County, Ark., a distance of 75 miles. Cost of project is estimated at $356,000.

» «

THE CORPUS CHRISTI RECYCLING CORP., Corpus Christi, Tex., plans the early construction of a welded gasoline pipeline from its recycling plant to a plant near Corpus Christi, a distance of about 35 miles. The project will include a booster station and all operating facilities.

» «

THE SOCONY-VACUUM OIL CO., is planning immediate construction of a 2000-barrel oil refinery at Shelby, Mont.

» «

THE SHELL PIPE LINE CORP., Houston, Texas will soon begin work on a 6-in. welded pipeline from its trunk terminal at Hobbs, N. M. to the Wasson and Bennett oil fields, a distance of about 30 miles. An extensive pipeline gathering system will also be installed.

» «

HUMBLE PIPE LINE CO., Houston, Texas is considering plans for the construction of a welded pipeline from Kelsey oil field in southeastern Jim Hogg County, Texas, to a point near McAllen, Hidalgo County, a distance of 60 miles. Booster stations for the line, together with other facilities, including the welding program, will bring the cost of the project nearly to $400,000.

SPECIFY DOUBLE WILLSON ONE-PIECE Flip-Front WELDING HELMETS

FOR ASSURED PROTECTION

WILLSON ONE-PIECE Helmets are formed from single sheets of wear-resisting fibre. Note deeply cupped shell, for close side protection, and long front bib to cover neck and chest. The Flip-Front composition glass holder, which is heat and moisture-proof, will not warp or corrode and is easily raised for inspection. Employs famous WILLSON-WELD Glass—a shade for every welding job.

Authorized Distributors will gladly furnish information on Complete Line of Welding Protective Equipment. Write—

DOUBLE WILLSON PRODUCTS INCORPORATED
READING, PA., U.S.A. Established 1870

Repair Shops

GETTING LEADS AT SMALL COST—Roger W. Hawkesworth of Roger's Welding Shop, Washington, D. C., is reported to be getting good results from consistent advertising in small space. He is using a single column 25-line ad on the sporting page of a local newspaper.

These "adigrams" say a lot in a few words and their pulling power is not proportional to their size, he states. "Portable electric and acetylene welding, bumpers, boilers, machines, pipes, motor blocks, expert workmanship," with an illustration of a welder at work are employed to turn white space into inquiries and orders, using his telephone number in the ad.

This shop has specialized on straightening frames, repairing rear housing and front axles, also white metal parts, grids for automobile radiators, etc. Mr. Hawkesworth has used large ads occasionally but found that they were not nearly so effective as a small ad run regularly. Sporadic advertising with big spreads costs a lot of money and does not bring returns worth the cost.

"Newspaper advertising is not a game for a quitter," he says. "If you don't get results

today you have got to keep pounding away at what you have to tell. Eventually results will start coming in and will continue to do so if the effort is maintained. Each ad tells the public who we are and what we do. We know definitely that more frequent advertising in small space is more effective than large ads taken more or less infrequently. These 'adigrams' keep our name and that of our business constantly in the public eye, which is what really counts. Their continuity and brevity give them punch and pull in the business."

Foreign News

THE BRITISH OXYGEN CO., an important factor in the United Kingdom welding industry, is believed to have earned record profits in 1938. Earnings in 1937 were equal to 26 per cent and this figure appears to have been exceeded last year. Helped by the growing activity on the British rearmament program and by the development of new uses, sales of industrial gases last year reached a new high record in the United Kingdom. Signs of price-cutting, however, have recently developed and acetylene is roughly back to its pre-war price. The current year is expected to be one of greater competition.

Current Reviews

AMERICAN STANDARDS AND SAFETY CODES (1939 Edition) has just come from the printer. The list includes some 400 nationally approved standards, safety codes, and specifications indexed alphabetically and also industrially according to subject. These cover work in the fields of civil engineering, mechanical engineering, electrical engineering, automobile and aircraft, transportation, ferrous metallurgy, non-ferrous metallurgy, etc. In each case these standards represent general agreement on the part of maker, seller, and user groups as to the best current practice in the industries or processes that the standards cover. More than 600 trade, technical, and governmental groups have taken part in this work. The list may be obtained free of charge by writing to American Standards Association, 29 West 39th St., New York City.

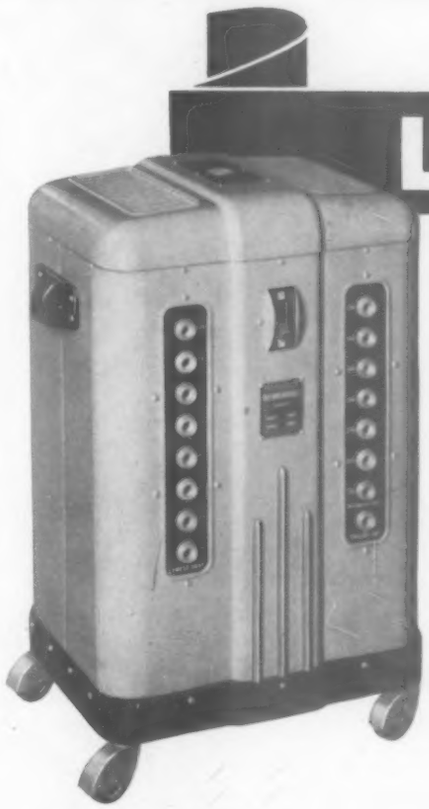
» «

CONTROL OF ATMOSPHERIC IMPURITIES—A definite answer to the vexing question, "How clean is the air where your men work?" may be found through procedures given in a new bulletin just issued by Air Hygiene Foundation, 4400 Fifth Ave., Pittsburgh, Pa. Air impurities cause much of the illness among heavy industry's 15 million workers. The bulletin, "Routine Sampling for Control of Atmospheric Impurities," was prepared by the Foundation's Prevention Engineering Committee, headed by PHILIP DRINKER of Harvard. It lists proved methods of collection, determination and apparatus for checking 45 dangerous substances commonly found in industrial atmospheres, such as ammonia, arsenic dust, benzene, chromic acid, carbon dioxide, hydrocarbons, lead dust or fume, mercury, methanol, sulfur dioxide, etc.

Two steps are involved in checking the air, the report explains, "first, measurement of air currents, and, second, estimation of impurities." The resulting data can then be applied to the design of control equipment or to checking the results brought about by such equipment. After recommending procedures for both high and low air velocity operations, the bulletin explains that for the purposes of selecting sampling and control methods, in relation to exhaust systems, several distinct types of atmospheric impurities must be considered.

INDEX TO A.S.T.M. STANDARDS— The latest edition of the Index to A.S.T.M. Standards and Tentative Standards gives information on all of the 870 standards as of January 1, 1939. The Index is of service to anyone wishing to ascertain whether the A.S.T.M. has issued standard specifications, test methods, or definitions covering a particular engineering material or subject and it is of help in locating the standards in the volumes where they appear.

All items are listed in the Index under appropriate key-words according to the particular subjects they cover. Copies of this publication are furnished without charge on written request to A.S.T.M. Headquarters, 260 S. Broad St., Philadelphia, Pa.



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Recent Patents

Welding Lugs to Chains

Automatic and continuous welding of caulks to chain links is provided by two machines which control the movement of the welding electrodes as well as the elements to be welded. Patents 2,148,502 and 2,148,503. John R. Reyburn, Fairfield, Conn., assigned to American Chain & Cable Co., New York, N. Y. Issued Feb. 28, 1939.

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Method of Welding

A new process for welding the edges of sheets of metal has been devised. According to this patent the edges of the sheets of metals are spaced apart in a direction tranversely of the planes of the sheets. The sheets are then fed into position in such a way that each sheet is in contact with one of a pair of welding electrodes, the sheet edges being brought gradually towards each other until they meet in a common plane where the sheets contact with the electrodes. At this point welding current passed through the electrodes forms a permanent joint at the meeting edges. Patent 2,147,868. Edmund von Henke, Chicago, Ill., assigned to American Electric Fusion Corp., Chicago. Issued Feb. 21, 1939.

» «

Welding of Fillets

One of the difficulties in welding a fillet in the corner of a metallic article is that the metal has a tendency to run down and to settle on one side. This difficulty has been overcome by using an electrode that is shaped to fit snugly in the corner where the weld is intended to occur. The electrode may take the form of a half-round shape, the curved portion of which fits into the corner. A closer fit is obtained by using an electrode having a right angle triangle cross section, the right angle portion being placed in the corner. Over the flat outer surface of either shaped electrode a shield of fabric is attached. The shield operates to direct the arc, or to confine it to a corner between two parts that are to be welded together. The electrodes may be coated with flux in the usual manner or they may be left bare. Such performed fillet electrodes operate satisfactorily to form a fillet without entailing any flashing of the metal from the article and without allowing the metal to accumulate in an uneven manner on one side of the joint. Patent 2,158,182. Robert Applegate, Shaker Heights, Ohio. Issued Feb. 21, 1939.

» «

Aligning Device for Welding Casings

Perfect alignment is recognized as one of the difficulties in the welding of long sections of pipe. Alignment is particularly important in the oil industry where long lengths of casing for an oil well must be joined. A device has been perfected which can be suspended on the rigging of an oil well and aligns the pipe during the welding operation joining the sections. The device is equipped with several clamping members adapted to be clamped on the casing sections, each of the clamping members being so constructed as to be concentric with the casing. The clamping units are carried by suitable rigid supporting sections spaced radially around the casing sections. The supports and clamps extend on both sides of the joint and leave a free working space completely around the junction. The device is adapted to be opened and closed with ease. Patent 2,149,394. John R. Gardner, Alvin, Texas. Issued Mar. 7, 1939.

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Application of Flux Coating

A flux embodied as a substantially non-deformable and preformed strip of accurate section is provided to be fed from an automatic welding head which also feeds bare wire for electrical contact. In practice the inventor feeds two such flux strips, one on each side of the bare wire, the inner concave surfaces of the strips encompassing the wire by passage through a pressure head. The flux covered wire is used directly in the welding operation. Patents 2,149,190 and 2,149,191. Arthur R. Allard, Drexel Hill, Pa., assigned to Westinghouse Electric & Mfg. Co., Pittsburgh, Pa. Issued Mar. 7, 1939.

» «

Welding Unit

A welding apparatus containing the usual welding jet and a number of preheating jets situated on each side of the line of welding ahead of the welding point. A feed supplies a welding rod to the welding point between the welding jet and the preheating jets. All the jets are fastened to a carrier which has a support which contacts the work ahead of the jets and supports in part the weight of the device. Patent 2,149,861. William Morton, Niagara Falls, N. Y., assigned to Union Carbide and Carbon Corp., N. Y. Issued Mar. 7, 1939.

» «

Coated Manganese Steel Electrode

To improve the welding of austenitic manganese steel a flux is provided which contains magnesium silicate and titanium oxide. Patent 2, 149,999. Walter Lair, Scotia, N. Y., assigned to General Electric Co., N. Y. Issued Mar. 7, 1939.

Flux for Mild Steel Electrodes

High-speed welding on mild steel base metal with either d-c. or a-c. may be obtained with a flux having substantially the following composition: Titanium oxide, 4 parts; Iron oxide, 1 to 5 parts; Sodium carbonate, 2 parts; Silica, 1 part; and Hydrated lime, up to 5% of the other ingredients. Patent 2,150,000. Walter Lair, Scotia, N. Y., assigned to General Electric Co., N. Y. Issued Mar. 7, 1939.

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Electrode Holder

An electrode holding jaw pivoted on the holder is actuated by spring-controlled unit which moves longitudinally on the holder. Patent 2,150,464. Albert Smith, South Gate, Calif. Issued Mar. 14, 1939.

» «

Welding Flux

According to this patent a flux is made by melting together silica and at least one basic constituent of the group of lime and magnesia, and then casting the resulting melt in relatively thin section and in contact with cold material to impart a vitreous luster on fracture. Patent 2,150,625. Lloyd T. Jones, and others, Berkeley, Calif., assigned to Union Carbide and Carbon Corp., N. Y. Issued Mar. 14, 1939.

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Ferrous Welding Rod

A high weld metal ductility with ample tensile strength and superior weldability may be obtained by lowering the nickel content and controlling the carbon and manganese content of nickel-steel welding rods. The improved rod contains carbon 0.05 to 0.25%, manganese 0.25 to 0.65%, silicon 0.05 to 0.30%, nickel 0.75 to 1.90%, and the balance substantially all iron. The sum of the carbon and manganese should not be over 0.80%. Patent 2,150,785. Robert M. Rooke, Jersey City, N. J., assigned to Air Reduction Co., New York. Issued Mar. 14, 1939.

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